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The State of England's Defense

Staggering Costs of a Policy of Unpreparedness

By Maj. Gen. J. F. C. Fuller*

TO ALL who, during the last few years, have closely watched the military development of Europe, it has become clearly apparent that the more the nations prepare for war, the less ready they find themselves to be. The reason for this is not the old historic one—that physical preparations are behindhand—but that, since 1919, a political revolution has swept over Europe, and war being, as Clausewitz long ago said, but "a continuation of peace policy by other means," no single nation is as yet certain what peace policy today entails. Until this question is answered, uncertainty of war policy must follow.

Whilst formerly a nation reckoned its war strength in bayonets, sabers and guns—that is, in numbers of men and in perfection of armaments—the changeover from peace to war conditions was comparatively a simple problem. But today, on account of every peace potential being simultaneously a war potential, these measurements no longer hold good. Therefore I consider that it would be most misleading to discuss merely weapons and men in this article. Though in England the output of weapons is rapidly becoming gigantic, my conviction is that seldom in her history has she been less well prepared for war, not only because *trained* personnel to use the bulk of these weapons is lacking, but because her traditional peace policy is antagonistic to a rapid changeover to a war policy of twentieth-century form. To make this difficulty clear demands a brief excursion into past history.

TODAY in Europe two political systems are in clinch, and both find their immediate origins in the Napoleonic wars. To distinguish them I will call the one the English and the other the Prussian system. The first successfully stood the test of that long conflict and was based on the accumulation of credit which in peace time financed trade and during war bought up allies—virtual mercenaries who fought England's battles for her. The Prussian system sprang from the idea of conscription and, after the fall of Napoleon, was developed by Prussia into the idea of the nation-in-arms, its high priest being General Karl von Clausewitz.

Whilst the first represented the trader, the ideal of the second was the warrior. The latter, despising trading in every form, long overlooked the power of economics and finance as instruments of conquest. Whilst Clausewitz was writing his epoch-shaking work "On War," another man, Andrew Ure, was engaged upon a now little-remembered book entitled "The Philosophy of Manufactures," which is worth quoting, for though essentially a "peace book," not only in it is to be found a vivid description of the English system, but it also shows how the English war policy of the years 1792-1815 became the English peace policy of succeeding years. He writes:

"The present is distinguished from every preceding age by an universal ardour of enterprise in arts and manufactures. Nationals convinced at length that war is always a losing game, have converted their swords and muskets into factory implements, and now contend with each other in the bloodless but still formidable strife of trade. They no longer send troops to fight on distant fields, but fabrics to drive before them those of their old adversaries in arms, to take possession of a foreign market. To impair the resources of a rival at home, by underselling his ware abroad, is the new belligerent system, in pursuance of which every nerve and sinew of the people are put upon the strain."

This system of economic war proved so successful that, from 1815 onward to about 1870, England became the workshop and banker of the world, and not content with the vast colonial possessions she had acquired, she set out by means of credits to establish loan-colonies in every quarter of the globe.

Whilst this formidable system of conquest was subduing nation after nation, the first reaction to it came from the general adoption of the railway, which, though it accelerated trading, enabled the conception of the nation-in-arms to take form by providing mass armies with an adequate means of supply. The first nation to realize its military importance was Prussia, and after winning the 1870-1871 war largely by means of it she entered into trade competition with England. This in turn led to the stupendous land-grabbing operations of the last quarter of the nineteenth century, during which an area three to four times the size of the United States was occupied by England, France, Belgium, and Germany. In turn, colonial possessions led to the creation of a powerful German fleet, and finally to the war of 1914-1918, which was essentially an Anglo-German conflict.

*Author: "Hints on Training Territorial Infantry," 1911; "Training Soldiers for War," 1914; "Tanks in the Great War," 1920; "The Reformation of War," 1923; "Sir John Moore's System of Training," 1925; "British Light Infantry in the Eighteenth Century," 1925; "The Foundation of the Science of War," 1926; "Imperial Defence, 1588-1914," 1926; "On Future Warfare," 1928; "The Generalship of Ulysses S. Grant," 1929; "India in Revolt," 1931; "Lectures on F. S. R. II," 1931; "Lectures on F. S. R. III (Operations Between Mechanized Forces)," 1932; "War and Western Civilization, 1832-1932," 1932; "General Grant (A Biography for Young Americans)," 1932; "The Dragon's Teeth (A Study of War and Peace)," 1932; "Generalship, Its Diseases and Their Cure," 1933; "Grant and Lee (A Study in Personality and Generalship)," 1933; "Empire Unity and Defence," 1934; "The Army in My Time," 1935; "Memoirs of an Unconventional Soldier," 1936; "The Last of the Gentlemen's Wars," 1937. Special correspondent, London *Daily Mail*, Italo-Abyssinian War. Major General, British Army, Retired. C. B., C. B. E., D. S. O. London, England.

During that war, England fell back on the identical means she had employed during her struggle with Napoleon. Being totally unprepared, she at once had recourse to loans and credits, and once again became the banker of her allies; yet with less success, because by 1917 she was financially exhausted and being compelled to borrow from the United States she became a debtor nation. This was a defeat of the first magnitude, almost as great as Germany's collapse, for it meant that she had ceased to be the banker of the world.

It was, therefore, in order to reëstablish her former financial supremacy that, immediately the war ended, she so fervently supported Woodrow Wilson's conception of a league of nations in spite of the fact that in principle it ran counter to the whole theory of British imperialism, because in it she saw an instrument which would maintain the *status quo* established by the peace treaties whilst she rebuilt her banking system. This required three things: (1) Rigid economy and therefore disarmament; (2) The funding of the American debt—approximately £1,000,000,000—and (3) The return to the gold standard, so that loanmongering might be reëstablished. The result was that the first wrecked the League, whilst the second and the third, coupled with reparations, ended by economically wrecking the world and, by doing so, cleared the way for the reëmergence of the Prussian system which had only been eclipsed and not destroyed by the loss of the war.

FROM that moment the whole world system built up during the decade following the signing of the peace treaties rapidly began to crumble. In 1931-1932 Japan flouted the League, which from then on tottered until struck down by Mussolini in Abyssinia in 1936. Between that year and 1939 the Comintern suffered a staggering setback in Spain. Thus the two great international systems which emerged from out the war were reduced to powder, leaving England faced by a problem she had so long neglected; namely, that of defense. What was she to do? Though territorially still the greatest of world powers, she was of all the great nations the least able to protect herself or her interest. Fifteen years of Baldwinism not only had resulted in her all but total disarmament and the virtual dissolution of her empire but had not reëstablished her former financial supremacy. *Vis-à-vis* a resurgent Germany, she was in fact in a far worse position than the one in which she had found herself in August 1914.

Even for a well-informed Englishman it is not easy to appreciate either the difficulty or complexity of the problem as it faced the British Government in the summer of 1936, when a change of policy became inevitable. On the one side stood the mass of the people, who for seventeen years had been inoculated with pacifism, and on the other the financial interest of the country, whose sole object was profit. The result was that nothing much happened until February 1937, when, with no considered plan in mind, the enormous sum of £1,500,000,000 was voted for rearmament—as if the difficulty could be solved by money alone. Obviously it could not be, because its solution demanded first of all a careful estimation of the recent development of German power, and secondly an unprejudiced survey of the strategical situation in which England was then placed.

As regards the first, the Government should have asked themselves this question: "What was the secret of Germany's all but miraculous military recovery under Hitler?" Had they done so, they would have discovered that it had very little to do with money power or gold but instead with a full and energetic application of the Prussian system; that is to say, as war is a continuation of peace policy, so inversely peace is a continuation of war policy. What then does war demand? (1) Complete authority vested in the government; (2) The economic self-sufficiency of the country; (3) The staunchest discipline of the people, and (4) The most powerful and up-to-date armaments obtainable.

It would then have been realized in Westminster that, because a parliamentary system of government permitted only of the realization of the fourth of these essentials, as a military power England could not compete with the authoritarian nations and that, consequently, in order to avoid war a change would have to be made in British foreign policy. This introduces the strategical problem.

IN ALL oceanic empires the strategical essential is the maintenance of sea communications, and in the British Empire the backbone, as it may well be called, of these communications runs from Quebec to London, and thence via Gibraltar, Malta, Suez, Aden, and Colombo to Australia and New Zealand. It is divided into three great vertebrae or sections —those of the Indian Ocean, the inland seas (Red Sea and the Mediterranean) and the Atlantic Ocean. So long as these three areas of ship movements are secure, the great axis, or backbone, is maintained intact; but should any one of them be blocked or commanded by a hostile power, the Empire at once flies asunder. Though it is possible, should the central vertebra be broken, to link the eastern to the western by the Cape of Good Hope route, the loss of the Mediterranean and with it the great strategical air center of Suez—Port Said, would result in such a fall in prestige as to constitute a major catastrophe.

This great backbone can be secured by one of two means: (1) To be so strong in all three sections that no foreign power bordering them will dare to attack it or, if this is not possible, (2) To be friendly with these powers, or in any case not to antagonize them. Yet from 1919 onward what do we see? That until 1936 no effort was made to assure the first method, and every effort to frustrate the second. Not only was Japan antagonized in the eastern sector, but also Italy in the central one. If that were not bad enough, England since then has accentuated her difficulties by antagonizing National Spain at the western end of the Mediterranean, and the Arabs at its eastern end.

And what is the result today? In Tientsin and Swatow Englishmen and English women are being stripped naked and paraded before mobs of Chinese coolies, not because the British fleet would be impotent in the China Seas but because, should it proceed there, Mussolini can close the door behind its back. In short, the state of England's defense in the Far East is now so miserable that, unless the U. S. A. is good enough to wash for her her dirty linen in the Yellow Sea, she risks being kicked out of Asia.

No expenditure of money will solve this problem. Its sole solution rests in England recognizing that she must either compound her differences with Japan, or once again secure full command of the Mediterranean by compounding her differences with Italy and Spain, which simultaneously means compounding her differences with Germany.

I believe that something like this was in Mr. Chamber-

lain's mind, and that, in the snail-like manner inseparable from parliamentary government, he was creeping in this direction when suddenly, in September 1938, he was faced by war and in spite of eighteen months of rearmament found the British defense locker empty. Worse still, France, who had been steadily rearming since 1909, was in as parlous a condition because two years of Popular Front government and the unbelievable corruption which characterized it had so gutted and demoralized the French fighting services that the very mention of mobilization threw a number of units into mutiny. Thus the orders of battle were: Two nations in alarms faced by two nations in arms. Consequently Mr. Chamberlain had no choice but to "fly to Canossa" and accept whatever terms Hitler chose to give him. Had he not done so, the probabilities are that France would have been swept by revolution.

ONCE again this crisis, like the Italo-Abyssinian, changed the whole problem of England's defense. So it came about that, under the cover of the somewhat transparent security afforded by the Munich Pact, instead of tackling the defense problem strategically, the English Government doubled its financial cost and literally went armament mad. There was no considered plan, not even an idea. Plants were set going to turn out weapons for an army of several millions of men and for an air force of thousands and thousands of machines; yet no steps were taken to enlist the men without whom all this metal was mere scrap iron. Somewhere behind the governmental brain seems to have lurked the thought that, when the crash came, other nations would buy these weapons with subsidies provided by The City.

Yet in France it was men who were required far more so than weapons. Having set out immediately after the World War to encircle Germany, and having at colossal cost built the Maginot Line to protect herself against a German invasion, by 1938 the French discovered that they themselves were encircled, and that as in another war they would require at least 500,000 men to hold the Maritime Alps and the Pyrenees, they had not sufficient left over to secure their Great Wall of China. What they wanted was men—trained, half-trained, or untrained—men who could pull a trigger; and England was the only source which could provide them.

From September 1938 until the next great crisis—that of March 15th the following year when Czechoslovakia disappeared as an independent country—the one topic of conversation between the French and English General Staffs was that of man power. Then, at length, on the 29th of that month, to the astonishment of the Chief of the Imperial General Staff—the Government's leading military adviser—the Prime Minister announced in the House of Commons that the Territorial Army, then on a peace establishment basis of 130,000 men, was to be raised to 170,000 and doubled, so that its total strength would be 340,000, to which was to be added 110,000 air and coast-defense troops.

The Territorial field force would then consist of eighteen infantry divisions, six motorized divisions and two armored divisions; but from where its officers were to come was not discussed, neither was it suggested that the forty drills a year for recruits or the fortnight's training for all ranks were to be increased. That this pleased the French seems highly doubtful; nevertheless it was a snail-like step in the right direction. Simultaneously a return was made to the traditional defensive policy; namely, the buying up of foreign allies. The origins of this move are interesting, as they show the extraordinary nervousness of present-day politics.

IMMEDIATELY following the German occupation of Bohemia and Moravia, speculations were rife, when a lady of some note, then on a visit to London, telephoned a political friend in Bucharest stating that she had heard that Germany was about to present an ultimatum to Rumania. Thereupon this friend telephoned it back to a certain London Ministry which authorized the issue of this fabrication to the press. The result was that such headlines as "Hitler's Ultimatum to Rumania" and "King Carol's SOS to King George" appeared in the London papers, and seemingly without verifying this "expected event" (which could have been checked immediately by telephone) the English Government forthwith guaranteed the security of Rumania. Then followed a deluge of guarantees: they poured forth upon Poland, Greece, and Turkey. Yet, in fact, they were nothing more than trade transactions, because each one was bracketed with a credit or loan—Rumania receiving £5,000,000, Greece £2,000,000, and Poland, so it is alleged, the substantial promise of £30,000,000.

The truth would appear to be that as armament production had completely outrun the man power to use it, and as most armaments are shifted on to the obsolescent list as soon as they are produced, a market had to be found to prevent English manufactories and arsenals becoming glutted with out-of-date weapons. As, in normal circumstances, the above-mentioned countries are in a chronic state of "stoney-brokeness," it was obvious, in order that they might purchase arms, they would have to be provided with a little pocket money.

How these credits are to be serviced has not been disclosed, but unless England is prepared to purchase vast quantities of Polish, Rumanian, Greek, and Turkish goods, obviously these countries will not even be in a position to pay interest on them. As regards Rumania, on whose loan interest has been fixed at six per cent, the English Government has agreed on certain terms to buy from her 200,000 tons of wheat, which Germany claims she has a call on. And what has been the result? With some justification Germany proclaims that she is being economically encircled, and apparently to prove this, according to the London *Daily Mail,* she is now seeking a barter deal with Canada, offering electrical apparatus and sugar-plant machinery in exchange for 10,000,000 bushels of Manitoba wheat!

I DOUBT whether in all history such an extraordinary defense problem has ever emerged out of unpreparedness. On the one hand we see the British Empire falling into a state of decay: the West Indies are derelict, Newfoundland is in the hands of the receiver, and New Zealand is approaching bankruptcy, whilst eighty per cent of the recent Australian loan was left on the laps of the underwriters in spite of the fact that it was issued at 98½ and was offered at the comparatively high interest rate of 4 per cent.

On the other hand we see huge sums being presented to a group of autocratic powers in order to clear the English munition factories and to prevent Germany trading with her eastern neighbors. The neighbors are so doubtful whether

the loss of German trade will benefit them that, according to the *London Fiancial News,* Poland is now asking for no less than £50,00,000 to £60,000,000, Turkey is following with demands for a further £28,000,000, and Rumania wants £12,000,000. It would appear that the spring panic started by a telephone ring-up is likely to prove somewhat expensive!

AS it is realized that these loans, whether spent on British armaments or not, offer little military guarantee to the countries accepting them—because in the event of war these countries are likely to be overrun by the Germans in a few weeks—in order to guarantee the guarantees so hastily given, the English Government, pushed forward by France, turned to the U.S.S.R. and sought her aid in the form of a defensive-offensive alliance. This took place in April and still, as I write at the end of June, the wrangle continues.

Politically, it has been announced again and again that the real bone of contention is the question of the Baltic States—Finland, Estonia, and Latvia, which do not want either a British or a Soviet guarantee, yet which the U.S.S.R. insists is imperative. This in actual fact is but a side issue and a smoke screen—a difficulty which without the slightest doubt could be solved by three moderate-sized cheques; and because so far they have not been made out, it is fairly obvious that the roots of the deadlock have not yet been disclosed. Nevertheless, to anyone who in recent years has traveled the Continent of Europe with his eyes open, they must be clearly apparent. In my opinion they are as follows:

No potentate in the world fears war more than Comrade Stalin, and no potentate has more reason to fear war, because the U.S.S.R. is the result of aggression against the various republics into which Russia broke up over twenty years ago, and so today fully half her population consists of conquered peoples, many of whom fought against the Bolshevik revolution. Though the Soviet army is immense, it is recruited from these subjected peoples, and only recently some 10,000 officers of various ranks were executed as traitors. Further, today, though it is never mentioned in the English press, there is still a semiguerrilla war creeping about in the Ukraine, and in Germany it is reckoned that no more than 400,000 officers and men are a hundred per cent reliable. This in a small way was corroborated by a well-informed Russian who, a few days back, told me that when musketry practice takes place, ammunition is issued out round by round so that the men cannot secrete it.

The truth, therefore, would appear to be that Stalin dare not risk a war. Should he lose, a counter-revolution is certain; should he win, then, for self-preservation, whoever is his commander in chief will have his head off. What terrifies him most is a war on two fronts; that is, simultaneous conflict with Japan and Germany. Consequently, if he can get England involved in a war with Japan, there is little likelihood of his having to wage war on the German front, because he realizes that once England is embroiled with Japan she will be too hard put to it to wage a war in Europe at the same time. It is, therefore, a British guarantee to enter a Soviet-Japanese war which, as I write, is holding up negotiations.

There is still another hidden reason for delay, little appreciated in England, which is causing further procrastination. Stalin is more pro-Russian than anti-German, and he realizes that economically the U.S.S.R. and Germany are complementary countries, and that politically they both have claims on Poland, which only a generation back was divided between them and Austria. Again, it is a curious thing that though over the table both countries increasingly hurl abuse at each other, ever since Weimar days there has been a good deal of furtive handshaking under it. In Germany you can insult Bolshevism and the Comintern as much as you like, but should you utter a word against Russia or the Russians the censor's blue pencil will come into immediate action.

It is true that at present both sides are uncertain of each other; but should England become embroiled in a war of the first magnitude in the Far East, certainty will I think appear, and if it does it probably will mean an amicable repartition of Poland.

THESE problems of politics and power, which may or may not be clearly grasped by the English Government, as well as increasing pressure from France, undoubtedly influenced the introduction of conscription. Yet here again, instead of boldly taking the bull by the horns and insisting on a two years' service, the minimum required for efficient training, a half-baked measure has been adopted. The present plan is to turn out some 200,000 to 250,000 6-month soldiers each year; what for is not exactly known (if so it has not been made public). To clarify this part of England's defense problem I will now turn to the question of man power.

A year ago, that is in 1938, the strength of the Regular Army in Great Britain was 170,000 (less reserves, some 150,000) and the strength of the Territorial Army was 160,000. In April this year these numbers were increased to 186,000 and 206,000, and now (in June) it has been decided to increase the former by 89,000, whilst on account of the doubling of the Territorial Army its strength to date stands at 410,000 and no doubt will reach the maximum of 450,000 shortly. Therefore, in the near future, it may be accepted that together these armies will total 725,000 men, to which a year hence will be added 200,000 Militiamen or conscripts. The grand total will then be nearly 1,000,000 men compared to 330,000 in 1938.

On paper this looks prodigious but, though it is, it is simultaneously fictitious, because practically the whole of the increase in men is minus officers. Therefore the most difficult part of the expansion program remains unsolved. To provide officers for the 89,000 additional Regulars will take several years; for the Territorial Army, unless the ages of field officers and captains are vastly reduced, many more, whilst the Militia, which is to be turned into the Territorial Army, must remain without its full complement indefinitely. In four years time it will be some 800,000 strong.

This difficulty, so I understand, is to be solved by a remarkable conjuring trick. As the field troops of the Territorial Army, 340,000 all told, will, on the outbreak of war, require six months training before being dispatched overseas, directly war is declared the Militiamen will replace the men of the Territorial Army, whilst its men will take the place of the Militia. In other words, the Territorials will go to the Militia depots for training, whilst the Militiamen will be taken over by Territorial officers and NCO's who are still untrained. What is next going to happen the future alone will reveal. Such an army may be good enough for the Maginot Line, though I doubt it, but for field operations it is obviously impossible.

ENGLAND'S DEFENSE EXPENDITURES

Year	*Army*	*Navy*	*Air Force*
1929	£ 41,232,870	£ 55,987,770	£ 16,880,564
1930	40,243,238	52,274,186	17,631,673
1931	38,623,757	51,014,752	17,868,948
1932	36,137,277	50,164,453	17,057,371
1933	37,540,428	53,443,545	16,700,794
1934	39,691,602	56,616,010	17,670,893
1935	44,654,483	64,887,613	27,515,185
1936	55,015,395	80,976,124	49,995,697
1937	82,174,000	105,065,000	82,500,000
1938	115,000,000	126,000,000	131,000,000
1939	161,000,000	149,000,000	205,000,000

HAVING raised this immense force, the next question which arises is how is it to be transported to France, because France is its only possible destination so long as Italy remains hostile. In 1914, the dispatch of 150,000 men threw the severest strain on British shipping, and since that date the merchant service has been reduced by some 2,000,000 and more tons. Besides this, there is now the problem of air attack to reckon with, not only in transit over the sea, but on landing, because the base depots for a million men will form extensive air targets. Quite logically, the French are now pressing for the construction of a Channel tunnel which, indeed, is a *sine qua non* of British conscription.

From this excursion into man power it will be appreciated that in spite of the doubling of the Territorial Army and the introduction of conscription, in the event of war in the near future the brunt of the fighting must for a considerable period fall on the three Regular defense services. Concerning them, it is not possible to enter into details because, quite rightly, their organization as well as weapon production are now kept secret. Yet some idea of the gigantic effort at present being made may be obtained from the service estimates.

Of all the defense services, the most remarkable has been that of the Royal Air Force, for though between April 1938 and April 1939 the increase in its personnel was no more than 22,000 men and by March next year should total 118,000, the Air Force estimates rose from £131,000,000 to £205,000,000—an increase of £74,000,000—a sum equal to the total cost of the Navy and Army in 1913. Its present cost is twelve times that in any of the years 1929–1934 and approximately double the aggregate expenditure on the three defense services in each of the years 1932 and 1933. Turning to the Navy, though the increase in its estimates stood at £126,000,000, this year they have risen to £149,000,000; yet personnel has been increased by only 14,000; that is, from 119,000 to 133,000 men. The bulk of this cash increase is due to construction, some sixty new warships being budgeted for, including two capital and twenty escort ships.

In their turn, the Army estimates have increased from £115,000,000 to £161,000,000, of which £55,000,000 are for warlike stores. In 1938 their cost was £38,000,000 and in 1937, £25,000,000. To these colossal expenditures must be added £42,000,000 for Air Raid Precautions, which in 1937 stood at £3,500,000 and last year at £9,250,000, as well as cost of food storage which has fallen from £8,500,000 to £5,000,000. In all, some £580,000,000 are this year being spent on military and civil defense, an increase of £192,000,000 over 1938, and of no less than £318,000,000 over 1937. Consequently, of the £1,500,000,000 voted in 1937 for a 5-year rearmament plan, £1,230,000,000 will be expended during its first three years. This means that, so long as political conditions remain as they are, £650,000,000 are likely to be spent in 1940, and at least £700,000,000 in 1941, when the quinquennium ends.

WITH these astronomical figures before us, the question may well be asked, as it is being asked: Can England or any other country continue much longer to withstand the financial strain? To start munition factories working is one thing, to close them down quite another. As the greater part of the money spent on such unproductive commodities as armaments is paid out in wages, in their turn wages go toward creating an artificial boom in consumable commodities. Therefore, should rearmament be suddenly curtailed, either by some change in the political situation or by financial collapse, it would seem certain that another economic deluge will submerge the world.

At the recent International Labor Conference at Geneva the following possibility was discussed. In its report may be read: "Rearmament cannot continue at the present rate without absorbing so much of the national income . . . as will prove intolerable. A point may come when defense expenditure will cause actual starvation in the lower-incomed groups. Some means of absorbing the workers thrown out of employment by the slowing down of armament production will have to be devised."

Here the totalitarian nations have a tremendous pull over the democratic, because by a stroke of the pen they can, at any moment, divert thousands of munition workers from unproductive to productive work. Paradoxically enough, it would seem, therefore, in the armament war now being waged, which in its way is as real a war as that of rifle and cannon, that unless England is prepared to adopt certain totalitarian principles, should the next war be much longer delayed, the greatest danger she is faced with is her own prodigious rearmament.

To Keep the Guns Firing

Equipment of the Modern Ordnance Maintenance Company

By Lieut. Col. Donald Armstrong*

THERE are said to be two schools of thought among Ordnance officers concerning the problem of maintaining Ordnance matériel in the field. One group holds that spare parts and nothing but spare parts will solve the field-maintenance problem. They might grudgingly admit a hammer, a chisel, and a file to the hallowed precincts of the company bivouac sacred to the spare part, but machine tools and welding equipment are decidedly taboo.

On the other hand, some mechanical geniuses would have only machine tools and in their ambulatory arsenals would manufacture all parts as needed. Each of these extreme views is, of course, its own *reductio ad absurdum* and probably no individual adheres to such ridiculous concepts. Nevertheless, there are gradations of opinion approaching one or the other assumption, which is the cause of debate in the matter of equipping a maintenance company.

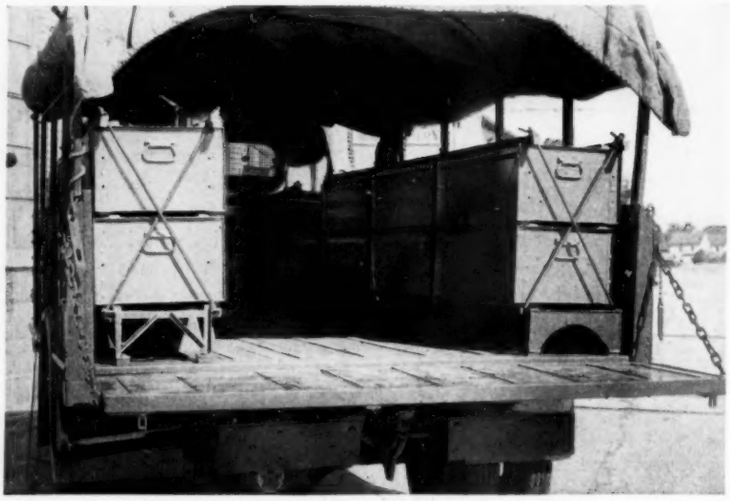

Fig. 1. Ordnance Spare Parts Truck M1

Fortunately, when the differences of opinion are examined calmly and dispassionately, many disagreements vanish. Fundamentally, every one is working toward the same end; *i.e.,* maximum mobility and therefore a minimum amount of equipment in an Ordnance maintenance company commensurate with its mission. Not one piece of equipment should be allowed in a company unless it can be proved to be absolutely indispensable. But what should this equipment be? The best approach to a solution of the question appears to be an analysis of the method of operation of an Ordnance maintenance company in active campaign. How does an Ordnance company do its work in a typical engagement?

Consider a division fighting against a stubbornly held defensive position. The reënforced divisional artillery has fired thousands of rounds and certain guns are reported out of action. Some tanks and scout cars have been hit by enemy fire but can be repaired, and others, as a result of their constant use, are in need of new parts. Machine guns and automatic rifles require replacement.

The 1st Ordnance Maintenance Company is intensely busy meeting with the requisite speed all demands for the repair or replacement of Ordnance matériel. Time lost by inoperative matériel never can be regained, and the fire of the 75's now out of action or the ability to use the disabled tanks might make a vital difference in the successful operation of the division.

At the Ordnance company bivouac, located some miles behind the front line, the telephone rings incessantly with messages from division headquarters telling, for example, of a tank near a certain cross-road or a 75-mm. gun behind a certain hill that is completely unserviceable and cannot be repaired by its own crew or by the maintenance section of the regiments. The emergency repair trucks carrying skilled Ordnance personnel and the necessary special tools, oxyacetylene welding set and the spare parts reported to be needed are sent to places like these, day and night, without interruption. The major portion of the company's rolling equipment, however, is located at the bivouac which has been approved by G-4 of the division. At that point the warehouses on wheels fill requisitions for parts to the limit of their resources. The machine-shop truck is turning out such spare parts as studs and bolts that are urgently needed but which are not included in the stocks carried on the spare-parts trucks, and is machining parts that have become unserviceable and have been repaired by welding. Occasionally, replacement parts also are being made while waiting the receipt of standard parts from higher echelons.

The other special vehicles at the bivouac are engaged in their particular functions in maintaining Ordnance matériel of all kinds in serviceable condition. But one point early becomes evident. The stock of parts carried in the spare-parts and cargo trucks is found wanting on occasion, and emergency measures have to be adopted.

THIS picture of the operations of an Ordnance maintenance company will not change to a great extent even if the corps instead of the division becomes the center from which the mission is carried out. However, Ordnance maintenance companies themselves will vary widely in strength, organization, and quantity of equipment, depending on the nature of the unit to which they are assigned. Nevertheless, every Ordnance maintenance company must perform certain

*Executive Assistant, Chicago Ordnance District. Formerly Chief, Maintenance Division, Military Service, Office of the Chief of Ordnance. Lieutenant Colonel, Ordnance Department, U. S. Army.

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basic functions which may be summarized as follows:

1. Parts of Ordnance matériel that are destroyed or damaged or are approaching the limit of their useful life must be replaced. This is the first and most essential duty of Ordnance companies and, if it were conceivable that all parts could be made available and could be transported by the companies, would represent 100 per cent of an Ordnance company's duties.

2. Spare parts are not always available or, if available, will not fit without preliminary machining or grinding. This necessitates the addition of machine-tool and welding equipment to meet emergencies to keep matériel operative.

3. Although the repair and upkeep of Ordnance matériel is the primary mission of an Ordnance maintenance company, it is short-sighted and incompatible with Ordnance Department policy not to render aid when aid is needed by any other arm or service that requires skilled Ordnance personnel and tool resources. The Ordnance company in bivouac is a center for the repair of all military equipment whose rehabilitation will advance the military mission of the unit to which the company is attached. This is a further reason for including machine tools and welding equipment in the company.

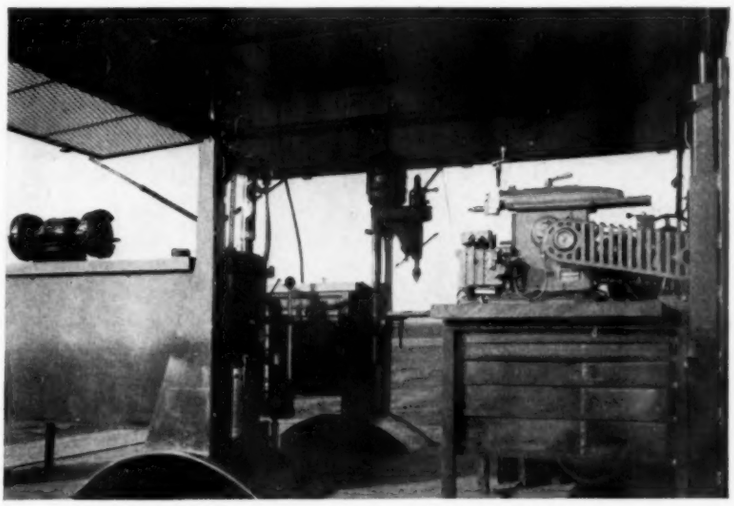


FIG. 2. ORDNANCE MACHINE SHOP TRUCK M3

Nobody will deny that the ideal plan of Ordnance maintenance in the field would be an inexhaustible supply of all parts and unit assemblies that might be needed for repair purposes. This is only a dream and impossible of realization. Such procedure would require a quantity of parts in the divisional Ordnance maintenance company that would represent a capital investment of astronomical figures and would demand vast numbers of trucks for their transportation. A compromise is necessary. As a result of careful records of parts consumption kept in time of peace, it is possible to prepare lists of parts ordinarily needed to keep matériel in serviceable condition. But this system will not give a correct answer to the problem of spare parts for all types of Ordnance matériel. In time of peace, automotive equipment is used as much and under conditions analogous to those of war time. Here the records of parts consumed will give very accurate data for the determination of parts to be carried by the maintenance company.

On the other hand, the employment of artillery on maneuvers has very little relation to the use of artillery in war, and peace-time consumption of parts will not give the desired information. Moreover, there is a constant inflow into the Army of new equipment so that at any particular moment experience tables are not available on the requirements of parts. Therefore, it is possible that not only through lack of parts but also because of lack of experience the right part is not available when needed. Add to this the well-known fact that spare parts frequently require some machining or grinding in order to fit them into the mechanism where they are needed. This is true not only because parts may vary somewhat in dimensions but also because the mechanism into which they must fit has become worn or warped and a special fit is required.

For these reasons, machine tools and welding equipment must be on hand so that parts can be improvised or repaired wherever possible until a new standard part can be furnished from agencies further to the rear. But let those antagonistic to machine tools take heart. There is nowhere any desire to have more than the simplest tool equipment, even in the heavy maintenance companies, and there is not the least danger of reintroducing the long train of machine tool trucks and trailers of the World War heavy maintenance company.

THE genesis of the present equipment for the Ordnance maintenance companies can be understood best by considering recent developments of vehicles and their equipment. In 1935, a 3-truck shop was standardized. The design of this 3-truck shop was based on the theory that on arrival in bivouac the machine-tool equipment would not be operated on the trucks but would be removed and set up in a tent or in a garage or other permanent building if one were available. Under these conditions the trucks then could be used as cargo carriers. The trucks themselves were theoretically 2½-ton 4 x 4 trucks.

There were certain manifest dangers and weaknesses in the proposal of separating the machine-tool equipment from the trucks and making the trucks available for general cargo purposes. If we were to assume a war similar to 1917 and most of 1918 on the Western Front, such a theory might be justified. If, on the other hand, we recalled the facts of the advance of the last months of war, and if we bear in mind that in this country a stabilized front would seem to be improbable, then the removal of the machine-tool equipment from the trucks and their utilization for cargo purposes would be extremely dangerous. Obviously, such a system would too frequently result, when a move was ordered, in not having the transportation available for the machine-tool equipment. Another defect is the time required to remove the machine tools from the vehicle and set them up for operation. Moreover, such a system would prevent, or at least hamper, the use of the repair facilities during short halts on the march.

One final factor provided the necessary impetus to start an entirely new development in the matter of equipment for the Ordnance maintenance companies. In the summer of 1937 the so-called "streamlined" Infantry division was tested

in Texas. The Ordnance shop, consisting of the three 2½-ton vehicles gave every appearance of being excessively heavy and bulky, and for that reason there was a decided trend to eliminate this equipment from the Ordnance company. Such a proposal seems absolutely inadvisable and these views are confirmed by the practically unanimous opinion of every Ordnance officer who has been in the field with Ordnance maintenance companies since the war.

Fig. 3. Ordnance Welding Truck—Cab Over Engine Chassis

To meet this trend to eliminate the 3-truck shop, an effort was made to reduce the size of the machine-shop and welding units, lower their costs, simplify the equipment and, if possible, mount them on less costly trucks. At that time the Maintenance Division learned of the steady development and constantly increasing use in commercial practice of the power take-off. This offered a fundamental aid to the design of a lighter type of equipment because the truck engine became the source of power for the operation of the generator needed on the machine-shop truck and for the welder on the welding truck and increased very materially the useful working space on the truck itself, so that the tool-and-bench truck could be eliminated.

In addition to the economy that has been realized by the use of the power take-off, the operating characteristics have been improved decidedly, particularly in the welding generator. Commercial practice has provided in the power-driven welding units a gasoline engine that works fairly close to maximum capacity with the welding set. The operators who have used the welding set driven by the truck engine report that the conditions of operation have been greatly improved because of the increased power of the gasoline engine on the truck and its ability to handle variations in load. In addition to the departure represented by the use of the power take-off, the new development included a special body that would facilitate work on the trucks themselves.

The automotive equipment of Ordnance maintenance companies must therefore include the following vehicles: (1) Standard cargo trucks for bulky parts, such as gun-carriage axles, engines, etc., and spare-parts trucks designed to transport the many hundreds of small parts needed for the maintenance of Ordnance matériel. These trucks will be located at the bivouac of the Ordnance company. (2) Shop trucks on which machine tools, welding equipment, and work benches will be installed and transported ready for immediate use. These trucks likewise will be located at the company bivouac. (3) Emergency repair trucks with a roving mission, which will facilitate repair by rendering first aid to matériel out of service, wherever it may be.

It is evident that there are three types of chassis required for an Ordnance maintenance company. A medium chassis will be used for the machine-shop truck, welding truck, automotive repair truck, small-arms repair truck, artillery repair truck and spare-parts truck. A chassis of this type has been tested under particularly arduous conditions at Aberdeen Proving Ground and has been found to give excellent service under the most adverse circumstances. The specifications call for a cab-over-engine type chassis which offers many advantages. The cargo trucks used for the transportation of bulky parts, such as spare 75-mm. guns, axles, tank engines, transmissions, etc., will be the standard Quartermaster 2½-ton truck. The emergency repair truck, representing the third type of chassis in the Ordnance maintenance company, will be a light one that provides remarkably good cross-country ability. A detailed description of the special Ordnance vehicles follows:

Spare Parts Truck.—Since maintenance in the field revolves around the spare-parts supply, the truck designed for the storage, transportation, and issue of the many hundreds of small parts needed for the care and upkeep of Ordnance matériel will be described first. Various designs were considered before adopting the present vehicle and its equipment. The idea of a specially designed body, with bins opening to the outside to facilitate access to the parts was particularly tempting. The convenience to be obtained in this way was, however, sacrificed to the greater good of using a standard-type body. The result was the spare-parts truck M1

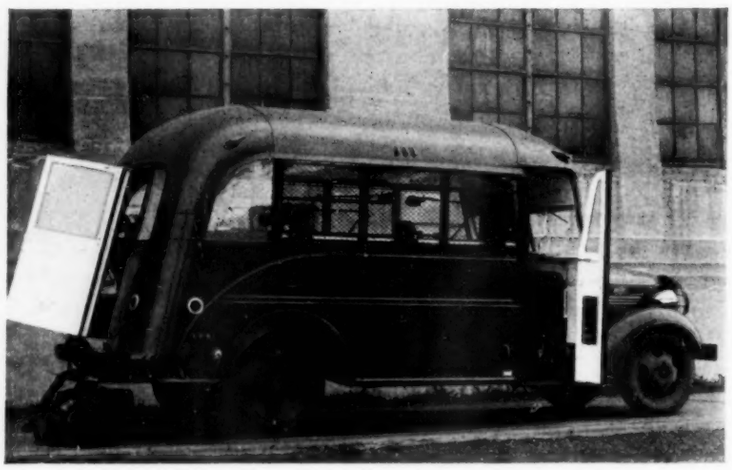


Fig. 4. Ordnance Small Arms Repair Truck M1

in which the proper segregation of parts, to facilitate inventory, issue, and safe-keeping, is obtained by the use of bins installed on each side of the truck, as shown in Fig. 1.

The bins are designed in sections weighing about 200 pounds with load. These sections fit into each other by means of a tongue-and-groove system and are held down by steel stay bolts and steel straps. The bins, which are accessible from the inside of the truck, therefore can be readily removed.

These trucks will have a pintle in order that they may tow a 1-ton trailer in which large and bulky parts may be transported conveniently, if later investigation proves that such a trailer is feasible and desirable.

MACHINE SHOP TRUCK.—The requirement has been noted for a special body designed to utilize machine-tool and welding equipment on the truck without delay and under conditions that would facilitate operations. Such a body has been designed and manufactured. (Fig. 2.) Ample tests have proved its convenience and its ruggedness. On the road, the top is in a lowered position, giving the best possible silhouette for travel. To obtain headroom of approximately 78 inches when the truck is in use, the top and upper hinged sides are supported by six stanchions into which hydraulic cylinders are built that provide a lift of about twenty inches. A pump located behind the cab operates the hydraulic system, which is of commercial design. With the raising of the top, the sides and back open automatically.

The body is built of steel with a wooden floor. The lower sides and tail gate, hinged at the bottom, form a continuation of the floor when dropped down. The chassis is equipped with a power take-off from the rear of the transfer case. On this truck, it drives, through V-belts, a 5-kilowatt generator installed in the forward end of the truck body. This supplies light and power on the truck with several conveniently located power outlets for portable electric tools.

FIG. 6. INTERIOR OF ORDNANCE SMALL ARMS REPAIR TRUCK

The truck is equipped with a 9-inch screw-cutting lathe, a 6-inch shaper, a ½-inch bench-type electric drill, a 60-ton hydraulic arbor press, bench grinder, ¼-inch and ½-inch portable electric drills, and 6-inch portable electric grinder. The lathe and shaper are installed on a bench running transversely at the front end of the body. Two work benches are installed at the rear of the body, one on each side, to which access is gained from all sides when the body is open. On these benches are installed the drill press, the arbor press, the bench grinder and vises, leaving ample space for mechanics to perform such bench work as is required of them. Under the benches are drawers and compartments for machine and hand tools and supplies.

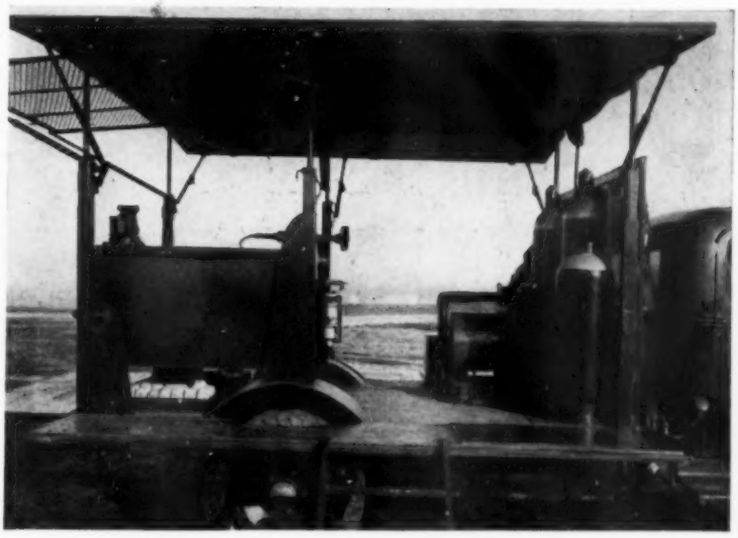


FIG. 5. ORDNANCE WELDING TRUCK—TOP RAISED AND OPEN

In comparison with previous designs of machine-shop trucks, it is evident that this particular vehicle carries equipment that is reduced to the simplest possible terms, is well adapted to repair work, and is far less costly and less difficult to procure.

WELDING TRUCK.—Welding is one of the most valuable and useful methods of maintenance in the field. Incidentally, as an art requiring highly trained workmen, no authorization ever should be granted to any but Ordnance personnel to weld Ordnance matériel. There are separate and distinct fields for oxyacetylene and electric welding, and both types must be available. Those who deny the necessity for electric welding should not forget that modern artillery carriages and other Ordnance matériel are fabricated by the arc-welding process. It is practically impossible to repair satisfactorily a damaged trail by the oxyacetylene method. For this work, electric welding is essential. Moreover, electric welding enables work to be done in places difficult of access, and reduces risk of fire. It has the further advantage of reducing difficulties of supply by minimizing the requirements of welding gases in the field.

The chassis and body of the welding truck (Figs. 3 and 5) are similar to the machine-shop truck described above. In the front of the body of the welding truck is located the power take-off, driving a 300-ampere welder and 3-kilowatt auxiliary generator for providing power for the electric weld-

ing equipment, electric drills and grinders, and for lighting. Located at the rear of the truck are two benches, one on each side, to which are attached vises and under which are drawers and compartments for hand tools and supplies. On the left drop side of the truck is located the steel welding table for use in connection with electric welding. Oxyacetylene welding equipment also is carried on this truck, so mounted as to be easily removable for use off the truck.

AUTOMOTIVE AND ARTILLERY REPAIR TRUCKS.—The chassis and body of the automotive repair truck are the same types used for the machine-shop and welding trucks. In this case the power take-off will operate the 5-kilowatt generator which will provide an additional source of power for maintenance operations. In addition to the work benches similar to those installed on the two trucks just named, this vehicle carries special tools and testing equipment required for automotive repair and maintenance.

FIG. 7. ORDNANCE EMERGENCY REPAIR TRUCK M1

The artillery repair truck uses the same chassis as the three trucks just described but has a standard Quartermaster body. It is merely the means of concentrating and transporting all special tool equipment needed for artillery-repair purposes in the organization to which the truck is assigned.

SMALL ARMS REPAIR TRUCK.—Certain kinds of repair work need special protection from inclement weather, dust, wind, and excessive cold and heat. Ordnance inspection and repair of small arms and optical instruments for example, obviously are included in this category. The needed protection as well as ideal working conditions with respect to ample light have been obtained by the type of vehicle known as the small-arms repair truck which employs a standard bus-type body (Figs. 4 and 6). The inside of the body is approximately 14 feet long by 7½ feet wide, entirely cleared for work benches, storage and aisle space, except for the driver's seat and controls. The body is assembled on the medium chassis.

Along both sides of the interior of the body are installed work benches from the rear of the truck forward to the rear of the driver's seat, and on the right-hand side is an additional hinged section that may be dropped down to form an extension for the work bench. The equipment of this repair truck consists of a rotating-bin section under each bench for carrying spare parts and small tools, drawers and compartments for larger spare parts and tools, and a 1¼-kilowatt gas-driven electric generator with ¼-inch and ½-inch portable electric drills and a 6-inch portable electric grinder.

A car heater provides heat in cold weather and the vehicle is so wired as to carry the current from the gas-electric generator to a complete complement of lights and plugs to accommodate electric tools. The generator is of the portable type and will be set outside the truck when it is to operate, as shown in Fig. 4. A door in the forward right-hand section of the body and one in the center of the rear afford easy access to the vehicle.

The small-arms repair truck using this body already has been standardized. This vehicle will be included in all types of Ordnance maintenance companies. A similar type of vehicle is particularly well adapted for maintenance of optical instruments, and it is now proposed to develop an optical repair truck which will be needed in only extremely limited numbers. Many officers using the small-arms repair truck in the field have pointed out that a truck of this kind also is well adapted for use as an office truck, and such a development might be advisable likewise at a later date.

EMERGENCY REPAIR TRUCK M1.—In time of war, an undue proportion of repair work performed at the bivouac of Ordnance maintenance companies would cause a most undesirable movement of Ordnance matériel from combat units in the forward areas to the rear. This would increase traffic on already overcrowded roads, remove equipment from the normal control and supervision of the unit commander, reduce the combat strength of the unit, and result in delay while the matériel to be repaired is awaiting its turn at the Ordnance shop. These difficulties can be diminished greatly by providing Ordnance maintenance companies with emergency repair trucks having unusually good cross-country ability and therefore able to go to the work instead of having the work go to the Ordnance repair center.

Wherever it is possible and necessary to repair matériel in place, the emergency repair truck is used (Fig. 7). A damaged gun carriage may be welded or repaired at the battery position or a tank that is broken down and incapable of movement may be repaired in place by the use of the emergency repair truck which renders first-aid service to damaged matériel wherever it may be.

For this purpose a light pick-up body truck has been found eminently satisfactory. The small size of the vehicle, its low silhouette, and its remarkable cross-country ability enable it to move successfully over any kind of terrain and to approach reasonably close to front-line positions under certain circumstances. The truck is an Ordnance special-purpose vehicle in which work benches and cabinets are provided for the storage and transportation of portable tools, equipment, and miscellaneous small hardware. It also can transport oxyacetylene welding equipment and to each truck is furnished a 1¼-kilowatt portable generator set, a 6-inch portable electric grinder, and ¼- and ½-inch portable electric drills. Hand tools and supplies of miscellaneous hardware complete the equipment of this vehicle. Finally, it is provided with a pintle so that it may tow to a bivouac a light gun which cannot be repaired in place.

In addition to the Ordnance maintenance vehicles that have been described, there are a few others, the distribution of which is so limited as not to warrant inclusion here.

The Officers and Directors of The Army Ordnance Association announce The Twentieth Annual Meeting of the Society, commemorating two decades of Industrial Preparedness for the National Defense of the United States, to be held

At Washington, District of Columbia

Wednesday, October 11, and

At the Aberdeen Proving Ground, Maryland

Thursday, October 12, 1939

(*Program overleaf*)

Program

Wednesday, October 11, 1939
Washington, D. C.

1:00 P.M. INDUSTRIAL PREPAREDNESS LUNCHEON, HOTEL WILLARD.
Col. Frederick H. Payne, Chairman, Committee of Three Hundred on Twentieth Anniversary, presiding.

2:30 P.M. INDUSTRIAL PREPAREDNESS ROUND TABLE.
Brig. Gen. C. T. Harris, Jr., Assistant to the Chief of Ordnance, U. S. Army, presiding.

7:00 P.M. TWENTIETH ANNIVERSARY DINNER, HOTEL WILLARD.
Brig. Gen. Benedict Crowell, President, Army Ordnance Association, presiding.

Principal address by Gen. George C. Marshall, Chief of Staff, U. S. Army.

Remarks by distinguished guests including Maj. Gen. C. M. Wesson, Chief of Ordnance, U. S. Army, and Brig. Gen. Earl McFarland, Assistant to the Chief of Ordnance.

Thursday, October 12, 1939
The Aberdeen Proving Ground, Maryland

10:30 A.M. SEACOAST RANGE.
Test Firing of Seacoast and Antiaircraft Matériel.

11:30 A.M. AIR FIELD.
Demonstrations of Aviation Ordnance.

12:30 P.M. LUNCHEON.

2:30 P.M. MAIN FRONT.
Test Firings of Field and Small Arms Matériel.

3:30 P.M. MAIN FRONT.
Tests and Demonstrations of Automotive Ordnance.

4:30 P.M. ADJOURN.

N.B. *Complete details, reservation forms and instructions will be sent to all members September 1st. Members are requested to communicate with the Secretaries of the respective local posts or executives of Ordnance districts regarding travel and other special arrangements. (Local posts and their officials are listed on page 77 of this issue.) Admission to the Proving Ground on October 12th will be by ticket to be issued upon request to members only and for their individual use exclusively.*

Our Present Military Position

*As Described by General Craig, Former Army Chief of Staff**

WE in the United States are singularly fortunate in that, through geographical advantages, through immense wealth in man power and national resources, and through the political advantage of peaceful neighbors, we are able to adopt the economy of a position in readiness. Most of the larger military powers are not so fortunate. They are confronted with an immediacy of attack which forces them to deploy, for instant use, the great proportion of national military strength. It is manifest, therefore, that at least for the present we may safely rely upon our distinctly characteristic pattern for national defense outlined in the National Defense Act of 1920. We escape the conscription of man power, the huge standing armies, and the great stocks of armament and equipment forced upon others.

But it is just as manifest that our system entails responsibilities that are, or should be, exactly binding upon those charged with its workability. The integration of our relatively small Regular Army, our reserve components, and our war industry is complicated. It presupposes an adequacy of numbers, training, equipment, and industrial preparation that is so closely applied that a deficiency in any of them endangers the whole plan. The essentials of the system—immediate initial protection, provision for rapid expansion, and the critical equipment to arm these troops—must be valid and real.

Furthermore, inefficacy of our military force is not confined to its own operations. There is a direct and close connection with our naval arm. Lack of military success in the protection of any naval base will restrict fleet operations dependent upon it. No navy, no air force, can operate except from protected bases. It is only necessary to allow hostile ground troops to advance over their bases and their manufacturing facilities and they cease to exist. Our people must not lose sight of the fact that ground forces constitute the basis of the defensive plan from the beginning, wherein they protect and give freedom of action to far-flung auxiliaries, to the final struggle for a decision, wherein it will be determined whether it will be our territory or some other which will be physically occupied by victorious armed men.

We are so educated in this fast-moving world that we are accustomed to new and attractive devices. We accept them in their final working capacities, forgetting the immense physical organization that fashions and services them. Neglect to organize properly any part of the physical background, or the infusion of damage at any of the vital places in the complicated set-up, nullifies the machine. New devices for war are of critical importance. To be without them invites failure. But we must never lose sight of the fact that we must guarantee their continued production and use. Much has been made of the recent use by one nation of a certain specialized war machine as a diplomatic advantage. Very seldom is the basic reason for that advantage introduced. Had not that machine been backed up and thoroughly protected at its vulnerable points by ground organization and ground troops, its contemplated use would not have influenced the situation. Another nation depended for national protection on mechanical advantage at sea. It is now hurriedly bolstering its ground forces lest another machine negative its own. Considered and concentrated attention upon the adequacy and efficiency of ground forces can never be neglected. There lies final success or failure.

DURING this past year the world has seen serious international tension. The attention of our people was immediately focused on the effectiveness of plans for the security of the country. This concern on their part extended not only to an examination of the composition of the defensive forces but also to the provision made for their effective use. In both were found serious deficiencies. The Army, still struggling toward its absolute minimum under the National Defense Act, was short much of its critical armament and equipment —critical because the matériel was not manufactured by industry except for war purposes and because the fabrication involved a time factor from several months to nearly two years.

There were deficiencies in personnel, not large, but vital to a force expected to have the great proportion of its strength prepared to operate on M-day. And there was a serious shortage in immediate war reserves—matériel needed to keep the war machine running until industry could be geared to produce it. Further, due to economic necessity, it developed that the War Department program had dealt with a restricted defense—one that would limit the power of decision and freedom of maneuver to narrow confines. The people, for the first time since the World War, awoke to the situation and felt the peculiar shock of helplessness that had been the constant attendant for years of those charged with the responsibility for their defense.

It is heartening to note the decisive action taken by the Chief Executive and by the Congress in response to this public concern. The War Department was called upon for a program which would put its house in order—not for the old restricted plan but for one reoriented along the strategically sound design of forward defense. It enabled the Army to alter its security measures and prepare to take up a position in readiness.

In devising the program recommended, the Army attacked the problem of its deficiencies from its main standpoints, all equally urgent and important. To disentangle itself from its former restricted status, it was necessary to provide for a more forward defense for itself and for the Navy, and it was essential that all these installations be equipped for immediate operation. It should be emphasized that this reorientation is not due to a special set of conditions arising from any international crisis. It is overdue from the standpoint of new and increasing strategic conditions. A comparative journey by stagecoach and modern airplane exemplifies the inroads upon time and distance made in transport within the last hundred years. Oceans have shrunk and weeks have become hours, with the military capitalizing heavily on the increase in

*These are extracts from General Craig's final report to the Secretary of War, June 30, 1939.

mobility. It is obvious that the people and property of this country must be protected from sudden and destructive attack which might come now from forward bases—later, perhaps, from home bases. In assuming our position in readiness, we must be cognizant of that point.

The improvements and changes made in the Army during the past fiscal year were designed solely along the lines of greater effectiveness of immediate protection through an advancement and strengthening of the outpost line, through the increase in strength of the Air Corps to balance the new conditions, and through the provision of vital armament and equipment in the hands of troops and in immediate reserve. Added to this was further provision (through the medium of educational orders) for shortening the time lag in those industrial plants to be charged with the manufacture of critical munitions at the outbreak of hostilities. . . .

The war reserve objective under the Protective Mobilization Plan contemplates placing in war reserve the critical items of equipment and munitions which will be needed to meet the requirements of the plan until such time as the rate of production by industry can meet military needs. Critical items of equipment and munitions are items of a purely military character which ordinarily are not available from commercial sources. . . .

THE most important need at this time is a clear definition of what constitutes adequacy in normal military defense. Much has been written and said during the past year by a variety of protagonists running the entire gamut of informed intelligence in military art. The resulting confusion in the mind of the mass of the citizens who pay for and receive the service of this military organization is natural.

It is simple common sense for the country to determine upon and maintain at a constant level a sound, reasonably constructed Army as a matter of pure economy and safety. The great outlay of money culminating in the appropriations of the past fiscal year was caused in the main by the failure to observe this precept during the so-called disarmament period. The pinching economy in national defense during that 10-year stretch resulted in a wholly inadequate military establishment. The wastage of public funds resulting from the neglect was bad enough, but such a dangerous state of national security should never again be permitted.

I wish to stress again the time element in preparation for war. This is an immensely rich nation, but all its wealth, all its industrial capacity, all its intelligent man power, are helpless before the inexorable demands of *time* in manufacture and training. The period has long passed when ineffectively armed or insufficiently trained men can succeed in war. We know to a day the time necessary to produce every item of armament and equipment—the time it takes to train our military specialists. As an instance, the sums appropriated this last year will not be fully transformed into military power for two years. This fact—that it takes years to resolve the will of the people into efficiently handled munitions of war—must be remembered. The same persons who now state that they see no threat to the peace of the United States would hesitate to make the same forecast through a 2-year period.

The net result of sane reasoning, of sound emergency planning, should be to move the short distance that still remains to place the Army in a position of readiness and, having attained that status, to so maintain it as a matter of continuing military policy. The relatively minor fluctuations necessary to balance the current international military situation can then be made promptly. The constant modernization of arms and equipment can be made smoothly and introduced economically.

THE components of the economical, properly balanced position in readiness for this country are as follows:

(1) *An outpost line for security and the protection of initial defense forces.* As previously noted, these ground and air forces must be prepared for immediate action. Their training, their equipment must be complete and their strength sufficient to withstand attack until reënforced. Panama and Hawaii, properly strengthened, and the proposed installations in Puerto Rico and Alaska constitute this general line.

(2) *The main position.* The forces available here—the Initial Protective Force, less those on outpost duty—consist of the remainder of the Regular Army and all the federalized National Guard together with those Reserves assigned to them in emergency. Certain have fixed defense positions. Some require short periods of conditioning and training before they are committed to action. It is evident and important that a certain proportion must consist of immediately available infantry-artillery teams—small, seasoned, hard-hitting divisions—that are available for instant dispatch to reënforce our forward positions, to seize or hold naval and air bases, or to destroy enemy bases. We have not now a single complete division of the Regular Army of the United States so available. We have four partial divisions and five brigades in various stages of completion and only a few special units available—medium artillery, tank, signal, engineer, and medical.

We urgently need to have always available five complete divisions at full peace strength, with a small complement of special troops, to meet the contingencies indicated. About 1800 officers and 23,000 enlisted men will provide the additional personnel required to accomplish this important purpose on a modest peace-strength basis. To disband our brigades in order to obtain five complete divisions would be a serious mistake, as these brigades will be needed as nuclei for the organization of additional Regular Army battle teams, and to lead in the defense of continental United States until National Guard divisions can assume full responsibility for this duty.

The soundness of our position will be nullified if we are unprepared to back up this Initial Protective Force with adequate reserve strength. Any emergency worthy of the name will demand the mobilization of our Protective Mobilization Force of a million men. Plans for that force must be real and complete. The critical armament and equipment should be on hand. In addition, the plans for a flexible levy up to any required strength must be soundly laid in man power and in procurement in case a concerted attempt is made to limit our political future.

From the foregoing outline, the adequacy or ineptness of our defenses always can be determined. In all fairness to the people, it is the military minimum that can be devised for them with accompanying assurance that they are properly protected. In consequence, they should require its accomplishment and demand its maintenance.

High Explosive Bombs

Debunking the Jargon that Makes the Headlines

By Tenney L. Davis*

IT has been said that war cannot be waged without things that go "Bang!" And the principle is true even in the warfare which makes extensive use of chemical agents. Powder must be burned before a bullet can be efficacious, and powder is frequently necessary to get the chemicals into the places where they are to do their work. We need guns to deliver bullets and chemicals and shells—unless the chemicals and the shells are delivered by airplane or by dirigible balloon.

And in these cases too we must have things which go "Bang!" High explosives are needed to put the things to work after they have arrived at their targets; it is necessary to scatter the chemicals, the burning phosphorus and the incredibly hot molten metal of thermite. The fact that the broken pieces of the ruptured chemical bomb also are scattered is relatively unimportant, for their effect is of little significance. But the equivalent, and more than the equivalent, of bullets are the fast-hurtling fragments of a high-explosive bomb. The effect of the high explosive itself, an effect so sudden that it neither needs nor tolerates confinement, also must be considered. Things go away from the place where a high explosive detonates. The space itself conducts electricity; the air is ionized—the electrons have been shaken out of the atoms. The effect is fearfully shocking.

Bombs for use against personnel must explode as soon as they hit. They must not penetrate into the ground if their fragments are to serve their purpose to best advantage. The explosive which is present in them during flight need by no means be insensitive to shock, but bombs loaded with a sensitive explosive cannot be carried safely by airplane. Bombs for the destruction of buildings and other property must not explode when they hit their target but first must penetrate into it. Landing on the roof of a building, the bombs should reach the basement before they explode. Their explosive charge must be insensitive enough to stand the shock of hitting the roof, of passing through concrete floors and of striking the girders, all this without exploding, and then to explode in response to the firing mechanism at a predetermined interval of time after the primary impact. Finally, all airplane bombs must be so insensitive that they will not explode if they are struck by an enemy bullet or shell fragment while the airplane is carrying them. These factors and ever-present considerations of cost and availability, determine and limit the choice of high explosives for use in bombs.

DYNAMITE and other explosives containing nitroglycerine are much too sensitive. In fact, the explosives which are suitable for use in bombs are ordinarily the same as those which are suitable for use in high-explosive shells. Bombs are not expected to penetrate anything which an ordinary shell will not penetrate, and it generally is thought to be unnecessary to load them with the extremely insensitive explosives which are used in armor-piercing shells.

For ordinary shells and bombs, trinitrotoluene (TNT) is probably the most satisfactory explosive we have. It will tolerate all ordinary shocks and will not explode from the impact of a high-powered rifle bullet. Yet it is detonated easily and surely by a fulminate detonator, a booster of compressed granular TNT being used to insure the better detonation of the main charge of TNT, which usually is cast. TNT is easy to purify to uniformly high quality. It is chemically inert and does not attack the metal parts of ammunition. It is easily loaded, and it is powerful in action. It falls just short of being suitable for use in projectiles intended to penetrate heavy armor. It is brisant enough for ordinary purposes, but an explosive possessing a higher velocity of detonation would have certain advantages.

A bomb or hand grenade or high-explosive shell serves its purpose best against personnel if the fragments into which it is blown are not too small. These ought to be of quarter-inch size or larger to do serious damage. Some authorities believe that slivers are more deadly than chunkier fragments, and all agree that the extremely small fragments which a high explosive stronger than TNT would produce would be relatively ineffectual. The heavy armor-piercing shells which are expected to penetrate into a ship and to explode with the production of fragments large enough to damage machinery, contain what seems like an amazingly small amount of explosive. The same considerations apply to the heavy bombs which are intended for the destruction of power plants, pumping stations, arsenals, etc., provided always that we limit the discussion to the consequences of a direct hit. If the shell or bomb falls near the building which it is desired to destroy, but fails to hit it, the explosive wave from the detonation still may do much damage. A highly brisant explosive even may cause a brick wall to collapse. A shell loaded with trinitrobenzene (TNB) will be more effective in this way than one loaded with TNT. But TNB produces smaller shell fragments. The problem here, as in so many other affairs, is to find the middle course.

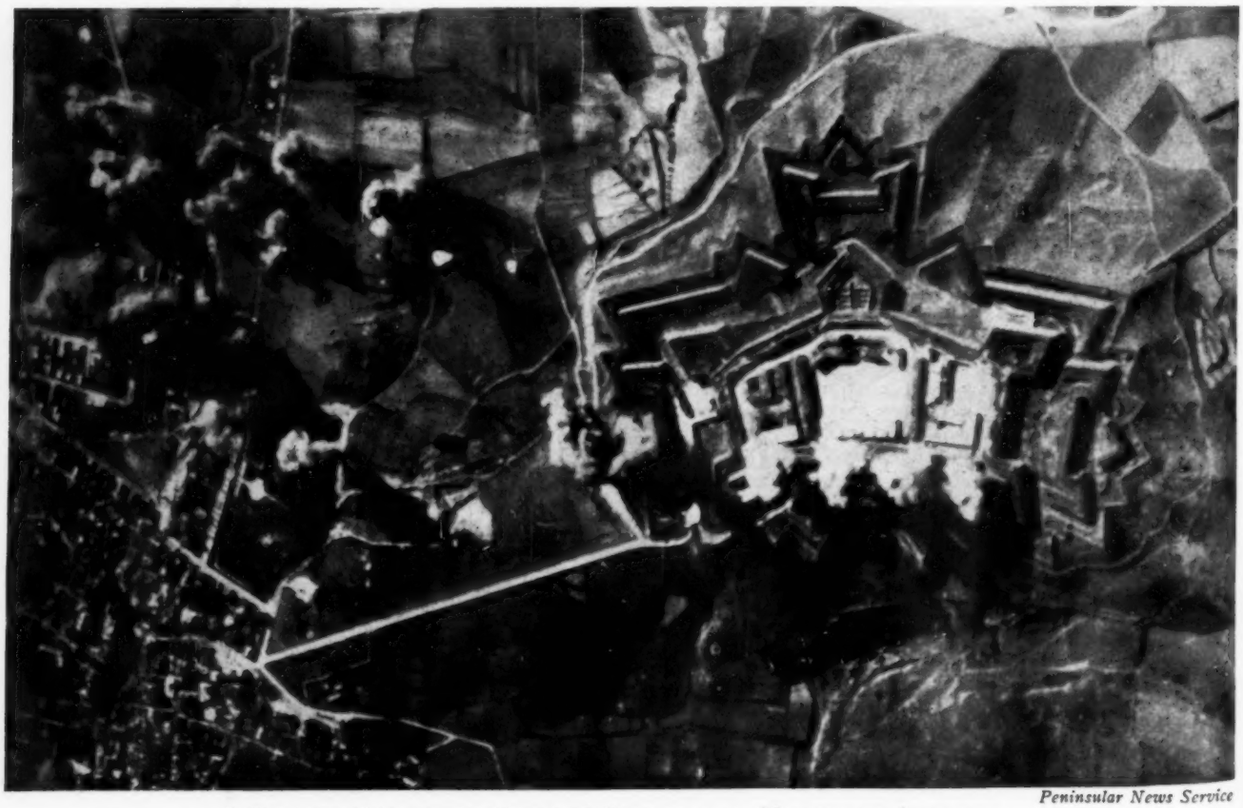
LIQUID-OXYGEN explosives have many advantages, but they are unsuitable—even impossible—for use in bombs. If an absorbent mass of combustible material, such as a cylindrical carton filled with wood pulp or cork dust or powdered aluminum, is dipped into liquid air or liquid oxygen, it takes up the liquid and the resulting cylinder is to all intents and purposes a stick of dynamite. It is a sensitive and powerful explosive, one which is cheap and easy to prepare, and one moreover which has notable safety characteristics—advantages for one purpose, disadvantages for another—because it will not keep. The liquid oxygen evaporates away, and the explosive must be used quite promptly or it will lose entirely its power to explode. Liquid oxygen cannot be prevented from evaporating. It cannot exist at ordinary temperatures. It can exist only if it is kept extremely cold, as it commonly is by its own evaporation. And liquid-oxygen explosives cannot be manufactured for use at a later time. It is clearly not feasible to make the explosive mixture in the airplane during its flight, and equally not feasible to con-

*Massachusetts Institute of Technology, Cambridge, Mass.

Aërial Bombardment in Modern War

Peninsular News Service

BOMBARDMENT OF MILITARY OBJECTIVES NEAR FIGUERAS IN CATALONIA, SPAIN, BY NATIONALIST AIRPLANES



Peninsular News Service

FORTIFIED POSITIONS IN CATALONIA BOMBARDED BY NATIONALIST AIRPLANES

trive a bomb in which the liquid oxygen and the combustible material should be mixed after the instrument had been released from the airplane.

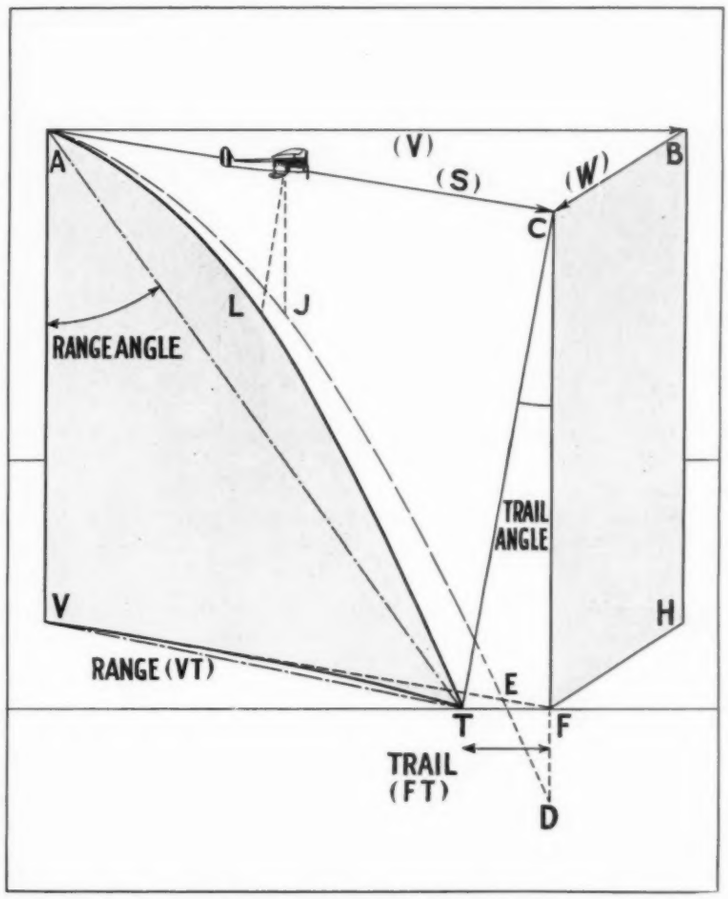
Almost any liquid which is a concentrated oxidizing agent will act in the same way as liquid oxygen. Fuming nitric acid is such a material, but it attacks metal and reacts promptly and at ordinary temperature with many combustile substances—without heat or any initial shock to start the reaction — producing heat, fumes, and often a fire or an explosion. If nitrobenzene is dissolved in fuming nitric acid, there is no immediate reaction, and the resulting liquid is a powerful, sensitive, and reasonably stable high explosive. It probably will detonate if the flask containing it is dropped by accident on a concrete floor.

Nitrogen dioxide is an oxidizing gas which is liquefied easily and which may conveniently and safely be kept in closed containers. Mixed with carbon disulphide or gasoline it forms an explosive called anilite. Powerful, very readily exploded by shock, the anilites would seem to be entirely unsuitable for use in a bomb since it certainly would explode if struck by an enemy bullet. Yet the anilites are cheap. During the World War the French made clever use of them. They had bombs built in two compartments, one for the liquid nitrogen dioxide and one for the carbon disulphide or gasoline. These contained no explosive and were perfectly safe. When such a bomb was released from an airplane, the small propeller on the nose of the bomb actuated a mechanism which caused the two liquids to mix. During its flight it became filled with an explosive so sensitive that it needed no detonator. The anilite bombs exploded on first impact with a target—and were used for the destruction of personnel.

Trinitrotoluene, picric acid, ammonium picrate, etc., are procured almost entirely from materials which occur in coal tar. They are expensive, and the source of their supply is limited. It is desirable that other explosives, as good or better, should be found which should be cheap and readily obtainable in any amount which might be wanted. The materials which result from the various processes for the fixation of nitrogen fulfill the requirement. They are produced from the air in a quantity which is determined solely by our will to produce them. Nitric acid and ammonia are used in the manufacture of explosives, but ammonium nitrate and nitroguanidine are explosives in themselves and have such desirable properties that we would wish to use them even if they were very expensive.

Nitroguanidine is made by chemical treatment of the fixed nitrogen resulting from the cyanamide process. It is a cool and flashless explosive about as powerful, weight for weight, as TNT. Mixed with colloided nitrocellulose it yields a propellent powder which gives no flash from the muzzle of the gun. During the World War, the Germans used Minenwerfer bombs loaded with a mixture of ammonium nitrate, nitroguanidine, and paraffin wax, a fairly insensitive composition which also would be suitable for use in drop bombs.

The use of ammonium nitrate clearly presents economic and strategic advantages, and it also conforms to the best explosives theory. The substance in itself is a high explosive, very insensitive to shock; it requires a special detonator which itself is a powerful high explosive. In addition, it contains much oxygen, and the products of its explosion are still capable of maintaining the explosive combustion of other material with which it may be mixed. It has two disadvantages: 1. It is hygroscopic; *i.e.*, tends to absorb moisture from the atmosphere, first caking and later becoming liquid. 2. It undergoes a change of crystalline form at about 32 degrees Centigrade which makes it unfit for use in propellent



THE TRAJECTORY OF A BOMB

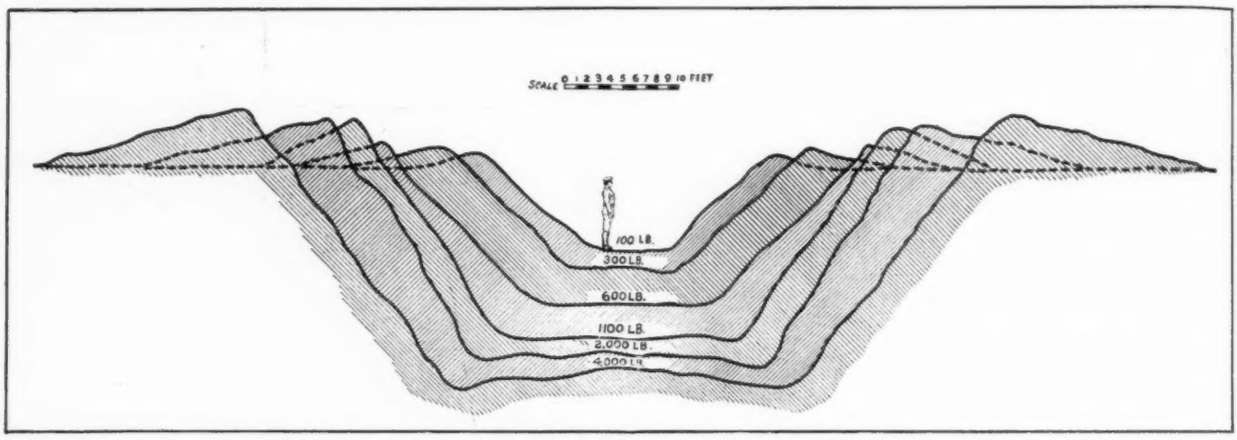
The airplane is traveling with air speed V and without wind would travel in direction AB. Wind, with speed W is in the direction BC and acting on the airplane causes it to "crab" along the line AC with ground speed S. The bomb is released at A. It travels forward with the velocity imparted by the airplane and downward to the earth by the force of gravity. With the airplane as shown, the bomb has traveled to L, having been retarded by air resistance. Had it fallen in a vacuum it would have reached J directly under the airplane on a parabolic path. The bomb strikes the ground at T, but had it fallen without air resistance theoretically it would have reached D, vertically under the airplane. Air resistance has caused it to trail behind by the distance TF. The actual trajectory will vary due to changes in speed and direction throughout the distance the bomb drops, and dispersion attributable to variations in weight, center of gravity, contour of the case, and bent fins of the bomb.

powders, the grains of which must retain their shape, but it does not affect its usefulness in high explosives.

TRINITROTOLUENE, and other explosives derived from coal tar, do not contain enough oxygen for their complete combustion, and they produce a black smoke when they explode. The unburned carbon, while it gives the artilleryman a means of observing the accuracy of his fire, nevertheless represents a portion of the charge which is not converted into explosive effect. If the carbon had been converted into gas—carbon monoxide, for example—instead of into smoke, then the explosive would have done more work. This work can be made available by mixing the TNT with ammonium nitrate, and additional work also is procured from the explosion of the ammonium nitrate itself. The amatols, used by the Allies in high-explosive shells during the World War, were mixtures of TNT with ammonium nitrate, usually in the proportions 80 : 20, 60 : 40 and 50 : 50. They exploded without producing smoke, and it was necessary to load smoke boxes with them into the shells in order that the artillerymen might be able to locate the position of the bursts. The smoke boxes usually were of pasteboard containing a mixture of red phosphorus and arsenious acid.

TNT melts at about 81.5 degrees Centigrade. The amatols are prepared by mixing the granular ammonium nitrate with the melted TNT, and then loading the warm plastic mass into the shells. Each particle of ammonium nitrate is thus covered with a layer of TNT and is protected from moisture. The TNT further serves as a cementing material or binder between the particles and, moreover, conveys the explosion to them and causes them to detonate. The probable course of events during the explosion is first, the detonation of the TNT, secondly, the detonation of the ammonium nitrate in consequence of the shock, and thirdly, the explosive interaction between the products which otherwise would result from the separate explosion of the two materials. Yet it is possible that the mixture detonates as such, for there are mixtures, none of whose components are explosive alone, which will nevertheless detonate from shock. And ammonium nitrate mixed with certain nonexplosive combustibles may be detonated by a powerful initiator or alone.

Still more ammonium nitrate may be used, more than enough to take care of the TNT, if some other combustible is added to the mixture. This combustible may be some substance which is not explosive in itself. A typical ammonal consists of TNT, ammonium nitrate, and aluminum powder. The aluminum powder exists in small flakes; these lay themselves down in the explosive mass in the manner of shingles on a roof and definitely make the explosive more resistant to moisture. The affinity of aluminum for oxygen is great; it burns with the production of much heat and of dazzling light. The explosion of ammonal makes a brilliant flash, and its action is more brisant than that of similar explosives which contain other combustibles.



CRATERS OF DEMOLITION BOMBS

The diagram indicates craters produced by demolition bombs varying in weight from 100 to 4000 pounds, using delay fuzes in ordinary ground. The crater of the 4000-pound bomb is 57 feet in diameter and 19 feet deep, with respect to the original ground level. This bomb displaced 1078 cubic yards of earth.

Nitroguanidine, unlike TNT, has no need of additional oxygen. The German Minenwerfer-bomb explosive, mentioned above, explodes in the first instance because of the nitroguanidine which it contains. This brings the ammonium nitrate into play, which explodes and reacts, or reacts and explodes, with the combustible paraffin.

Ammonium nitrate contains more oxygen than it needs for its own explosion, and for reasons of economy ought not to be used as an explosive unless mixed with some combustible substance. A suitable combustible, like powdered aluminum, or magnesium, or zinc, increases its power very greatly. The further addition of some explosive, like TNT, which may be detonated easily by the ordinary methods, makes the mixture capable of being detonated by the usual means. But a mixture of ammonium nitrate with powdered aluminum, while extremely insensitive, is still a powerful high explosive. It may be detonated by means of an appropriate arrangement of primary explosive and booster charge. Ammonium nitrate from the fixation of nitrogen may truly be said to be made from air. We suspect that the bombs, described in the war news from Spain as loaded with an explosive which was made from air, probably were loaded with ammonium nitrate and aluminum powder, or with a similar mixture.

EDITOR'S NOTE.—Other articles by the same author which have appeared in ARMY ORDNANCE include "Explosives from the Air" (Vol. III, No. 16, p. 193), and "Kunckel's Discovery of Fulminate" (Vol. VII, No. 37, p. 62).

Ordnance Research

The Importance of Uniform Metal Products for Armament

By Maj. Scott B. Ritchie*

PREPARATIONS for national defense are based upon the application in warfare of developments in the arts and sciences. Practically every advance in scientific and engineering knowledge has its place in our means of defense in which metal products now play a vital rôle. Modern war takes its character from the machine age in which we live.

The limiting factor in the early mobilization of an effective army for a major war lies not so much in the recruiting of the man power required as in the provision of the mechanical aids and equipment—munitions, if you please—whereby the armed forces may be made most effective in the field. The days when wars were won by heroism alone are gone. Future wars will be decided by industrial preparedness and applied science. Superior airplanes, battleships, tanks, and guns; superior methods for detecting and combating these weapons; superior methods in producing munitions in large quantities, economically—these will be among the factors that may decide the fate of this nation and of our entire civilization.

The tools of war are increasing in complexity—many are strictly noncommercial and present serious difficulties in manufacture. Industry, which now must assume a dominant rôle in a major war effort, is normally unfamiliar with these products, and the manufacturing methods are in many cases entirely dissimilar to those used under peace-time production.

The situation today is complicated because we are in an age of motorization and mechanization. Everything is being speeded up for the reduction of space and time. Since armies reflect the civilization in which they live, they likewise are being speeded up, with the result that warfare is becoming more and more an engineering problem.

TOO much emphasis cannot be laid upon the great importance to national defense of uniformity, high quality, and dependability in metal products used in munitions. Greater and greater reliance is being placed upon machines, and unless these weapons perform successfully they may be worse than useless. To use a trite statement, a chain is only as strong as its weakest link. To send to the front a thousand armored tanks, which, due to some inferior part, may fail at a crucial time, would only dissipate energy. We need the very highest quality obtainable, but we cannot lose sight of the fact that huge quantities of material are also required to support a modern military effort. Perfection in the item is the ideal sought; but a perfect product, unless it can be produced by industry and supplied to the armed forces in sufficient quantities and in the time required, again is of no avail. There must be a suitable balance between the requirements on the one hand and the technical competence and capacity of industry on the other. Production, then, becomes a responsibility of the first magnitude—production of the best materials obtainable in quantities to meet essential needs.

This suggests the importance of uniform standards and uniformity of metal products. There are some 7300 principal items of equipment and supply for use of our troops which must be procured, while the number of components for those complete articles total hundreds of thousands. Many of the items are not in commercial production in our country. Consequently, the exact production methods peculiar to these items are not generally known to industry. Yet the War Department must, in a major emergency, depend upon private industry for more than ninety per cent of its requirements. The arsenals will produce less than ten per cent. Many private plants, therefore, may be called upon to make items with the production features of which they are not now familiar.

Availability of common standards will greatly facilitate handling of new manufacture. Standardization within industry so that machines, methods, and materials are uniform in a given industry would be a great contribution to national defense. Simplified practice also means economy and increased efficiency and will help to shorten that critical period during which war reserves of munitions are necessary to cover industry while its tools and other manufacturing equipment are being arranged for war production. Any constructive steps taken to facilitate this transition will be significant contributions to national security. The educational-orders program now under way is a fundamental step in that direction.

Our designs must, of course, give us material at least the equal of that of other countries, but they must be based on the use of commercial materials and capable of being produced by commercial processes and methods. Economy and speed of production are dependent largely upon the care given to production features of design. The types adopted as standard must be of such character that they will permit mass production in sufficient quantities to meet requirements.

IN design and standardization we maintain close contact with industry and with various technical societies, such as the American Standards Association, the American Society of Mechanical Engineers, the American Society for Testing Materials, and others. They give us much help. Our collaboration with them is highly important to assure that adopted commercial standards are adaptable to War Department needs and that our designs are fitted to industrial processes as closely as military requirements will permit. Our drawings and specifications *must* be adapted in peace time for mass production in war.

The interchange of technical data and experience between civilian agencies and the War Department is especially valuable to national defense. Without this coöperation, many of our advances in the art of munitions production would not have been possible. This is especially true with respect to the Ordnance Department.

Our system of industrial preparedness focuses attention upon the paramount importance of two fundamental factors

*Chief, Allocations Division, Office of the Assistant Secretary of War. Major, Ordnance Department, U. S. Army.

This is an address delivered at the joint spring 1939 meeting of the Franklin Institute, the Philadelphia Ordnance Chapter of the Reserve Officers Association, and the officers of the Philadelphia Ordnance District at Franklin Institute, Philadelphia, Pa.

in our industrial organization which have a direct application to the adequacy of munitions: first, *research and development* to insure the most effective material made possible under the existing state of the arts and sciences, and secondly, *production engineering* to insure that the items can be procured in mass production, of satisfactory quality, in the most efficient and economical manner.

I should like to outline briefly the position of the Ordnance Department in these matters. Its mission is to supply our troops with Ordnance material in the quantities needed and at the place and time required. This involves the design, development, procurement, storage, issue, and maintenance of practically every offensive and defensive implement essential for the successful prosecution of war. The diversity of the problem and its technical aspects are signaled by the fact that there are over 1200 separate Ordnance items together with some 250,000 components in the general categories of cannon and their mounts, rifles, pistols, and machine guns, fire-control instruments, tanks, combat cars and scout cars, bombs and pyrotechnics, and all types of small-arms and artillery ammunition. These items are noncommercial and embody in their design the application of every branch of science.

Obviously both research and production are involved, and in these activities the Ordnance arsenals play a major rôle. They are highly important in our scheme of national defense, not so much as production centers, but rather as experimental laboratories to keep alive the art, to set standards, to determine costs, to uncover production difficulties, and to train inspectors.

THE Chief of Ordnance regards research and development as responsibilities of the first magnitude. (See "Arms for the Army," by Maj. Gen. C. M. Wesson, Chief of Ordnance, in ARMY ORDNANCE, January-February 1939, Vol. XIX, No. 112, p. 207.) What is satisfactory today may be obsolete tomorrow. Other nations are continually developing new weapons and improving existing types. In some countries abroad, practically every university and every research organization is working intensively on military projects in one form or another. That is the situation with which we must compete. The Ordnance Department of course must be alert continuously as to engineering and scientific developments at home and abroad, which even though not primarily of a military character, may be used in producing more efficient fighting machines.

But, further than this, there are certain research activities which must be carried on directly by the Ordnance Department because industry itself conducts no research along these lines. In this category comes the science of ballistics—interior and exterior—an extremely broad field involving shapes of projectiles, rifling in guns, composition of powder, shape of powder chambers, methods of ignition, methods of banding projectiles, shape and size of powder grains, all types of fuzes and bombs, and other items too numerous to mention. In this category also fall the complicated problems of fire control. In the automotive field are the problems of tracks and track suspensions for high-speed track-laying vehicles, special transmissions for handling powerful motors, and the cooling of engines under adverse conditions. Pages could be devoted to the problems which may be classified as ordnance engineering peculiar to the ordnance problem and not solved by industrial research.

Quoting freely from the reference given above, this phase of the Ordnance problem, in the judgment of the Chief of Ordnance, never has received sufficient recognition, nor adequate funds. For years, the funds allotted for all research and development have been limited to slightly over one million dollars annually. Out of this amount must come not only funds for research, but also the cost of designing and building new and improved types of equipment, and all tests, both engineering and service, including the necessary ammunition in connection therewith. There are 496 research-and-development projects on the Ordnance books today. Considering the broad and complicated field which the Ordnance research-and-development problem presents, the one million dollars spent by the Ordnance Department for the purposes I have outlined seems small in comparison with the amounts spent by private corporations.

The funds spent now for research determine whether or not our equipment will compete successfully with that of foreign countries five to ten years from now. It follows as a natural consequence that the funds provided in any one year should be part of a carefully planned program covering a considerable period in order to insure continuity. The policy of the Ordnance Department in research is to avoid duplication and undertake only that research which is necessary for progress and which is not conducted by private industry. And further, research initiated by the Department is carried only to the point where industry will assume the burden. A case in mind is the basic investigation performed at Watertown Arsenal in the substitution of molybdenum for tungsten in high-speed tool steel. A private firm became interested and carried the work further to the point where molybdenum high-speed tool steels now are produced commercially by a number of licensed concerns, thereby rendering tungsten strategically less significant.

THE Department maintains laboratories for research as follows: Watertown Arsenal, Watertown, Mass. (metallurgy, general and ferrous); Picatinny Arsenal, Dover, N. J. (chemistry and explosives); Frankford Arsenal, Philadelphia, Pa. (optics and acoustics and nonferrous metals); Aberdeen Proving Ground, Aberdeen, Md. (ballistics and automotive); Rock Island Arsenal, Rock Island, Ill. (oils, cleaning and preserving materials).

Although funds available for research have been limited, accomplishments have more than justified the expenditures made. Typical developments since the World War in the metallurgical group alone, some of which have been of valuable utilitarian service to the nation at large, are as follows: The centrifugal-casting and cold-working methods applied in gun manufacture, removable liners for artillery, introduction of new alloy gun steels, application of welding in the construction of mobile gun carriages, improvements in light armor plate and armor-piercing bullets, and developments in instruments and technique for examination of metals.

Ancillary to the developments just mentioned have been the improvements in testing methods, notably impact and X-ray. Both have had a beneficial influence in the production of better ordnance metals. Deep therapy to test for the existence of internal flaws affords a process control for the foundry and the fabricating shop, especially in welding, to develop proper welding technique in which such elements as skill of the welder, composition and thickness of plate, and type of welding rod enter the picture. Similarly, diffraction

X-ray equipment implements research into internal stresses, identification of crystalline structure, and other fundamental factors influencing the quality of metals.

The foregoing activities are mentioned merely to illustrate the type of metallurgical research with which the Department must deal. There are many basic problems waiting to be solved, some of which will be referred to below. To industry and the professions we look for help.

THE Ordnance Department, within the limitations of available funds, also conducts investigations to improve methods of manufacture. A typical case may be of interest.

As a result of the survey of industry incident to procurement planning, it was found that the existing industrial equipment suitable for production of the larger 1-piece bomb cases—presses and draw benches, the only standard method of manufacture prior to the present fiscal year—was very limited and wholly inadequate to meet emergency requirements. The thickness of the metal in the nose section of this design of 1-piece demolition bomb case limits the methods of manufacture to cupping a plate or piercing a billet and drawing. This process requires heavy presses and draw benches, and considerable machining of the case is necessary to obtain finished dimensions. In war time, therefore, this would also throw an extra burden on the machine-tool industry, already limited in capacity.

It has been found that swaging or spinning a seamless tube to the required exterior shape and dimensions of a bomb case does not give the usual thickness in the nose section. However, a bomb case of equal or superior strength can be obtained by this method if the tubing be made from steel of higher physical properties. This development led to the manufacture in industry last year of large-diameter seamless tubing having a minimum tensile strength of 95,000 pounds per square inch which has been followed recently by the spinning on a commercial basis of large-diameter tubing having a minimum tensile strength of 105,000 pounds per square inch.

Paralleling this has been the development in the manufacture of large bomb cases from formed and welded plate. This is now a standard process for manufacture. Further improvement in the physical properties of the steel in large-diameter seamless tubing and welded plate offers the possibility of obtaining bomb cases of superior qualities. This improvement in bomb manufacture is typical of others continually in demand and is somewhat analogous to the production engineering in the manufacture of artillery shell described in a recent article by Lieut. Col. Levin H. Campbell, Jr., of Frankford Arsenal ("Artillery Ammunition Production": ARMY ORDNANCE, March-April 1939, Vol. XIX, No. 113, p. 273). In such work, the Department, of course, must take the initiative, but when our problems are properly presented, industry fully coöperates in their solution. The result is mutually helpful and in the interest of industrial preparedness.

Ferrous metallurgy naturally is all important in the munitions program. Iron and steel are the very essence of munitions; yet nonferrous metals are also vital. When we consider that aluminum and its alloys constitute eighty-five per cent by weight of an airplane proper, the importance of that metal to military aviation is manifest.

To digress for a moment to another type of service, we find that in the field of military communications, metallurgy has played and is playing an increasingly prominent rôle. New weapons, new tactics, rapid transportation, and effective aërial scouting have made new and exacting demands upon communications facilities coming under the Signal Corps. To satisfy such demands, industry has been quick to devise new materials and new processes. For example, the need for extreme sturdiness with minimum weight in aircraft radio equipment has brought forth many novel applications of the already familiar aluminum alloys. Military telephone equipment has become both lighter and more effective with the developments of the magnetic cementites of iron and cobalt. Field telegraph printers have become practical for military purposes largely as a result of mechanical improvements made possible through the introduction of fatigue-resistant beryllium-bronze elements into their delicate mechanisms.

The wire requirements of the Army and Navy, ranging from submarine cable to fine thoriated tungsten filaments for vacuum tubes, are necessarily severe, particularly with respect to uniformity in physical properties. A hard spot in a single strand of a wire rope may cause a break, costing the lives of a dozen men and the "washout" of a hundred thousand dollars' worth of airplane. A slight variation in cross section in a delicate magnet wire may throw a radio set "off the beam" with fatal results. A batch of brittle steel finding its way into field telephone wire—and we have another "lost battalion."

LET me use another Ordnance item, the small-arms cartridge case, to illustrate research, development, and production engineering in an effort to insure uniformity required for metals used in the manufacture of small-arms ammunition. Long experience in the manufacture of cartridge cases has shown the necessity for uniform metal in order to prevent latent defects such as corrosive season cracking, split bodies, and defective primers.

When a cartridge case is processed through the various drawing operations, it receives a great amount of cold working. Slight variations in physical properties will result in setting up internal stresses in the thin walls of the case which are conducive to body and neck splits, particularly after prolonged storage. Furthermore, these variations will result in a lack of uniform hardness in the head of the case, which will cause the primer socket of the soft-head cases to enlarge and permit primer failures, such as loose and blown primers. To insure a degree of uniformity, specifications demand, in addition to certain chemical requirements, that the metal pass requirements as to grain size. However, there have been occasions when latent defects were erroneously attributed to lack of uniformity in the metal when it was later discovered that the trouble was due to improper processing of the case.

For a long time, body splits were attributed to unsatisfactory metal. This defect, however, recently has been found in most instances to have been caused by internal stresses in the wall of the case resulting from cold working during the various drawing and priming operations. If the cartridge case is fabricated in such a way as to provide the proper differential of hardness from the head of the case to the neck, it may be made quite hard without danger of latent defects.

It is particularly important that metal used for primer cups be very uniform so that the finished cup will be sufficiently strong to prevent the firing pin from piercing the cup, and yet soft enough to crush properly the primer pellet against the primer anvil. Cartridge brass and cartridge-case

manufacture provide a fertile field for research engineering.

Industrial research on metal products is concerned primarily with the properties and characteristics of materials and correlation with details of processing control. Suitable control in all processes becomes imperative to insure that the product is of uniform characteristics. Proper specifications, coupled with thorough inspection procedure, tend toward that end. Yet there are many steps in the fabrication where hidden defects may creep in to cause the rejection of the material in process. This means loss of money, and what is worse in war, loss of the priceless element—time. Crude equipment, poor technique, the human equation—all may result in non-uniformity of product which may not be discovered until tested in the hazards of war to the jeopardy of national defense.

Interchangeability of parts in the art of manufacture laid the foundations for mass production which now has been developed to a high degree of perfection by the use of machine tools, gages, dies, jigs, and fixtures. But interchangeability of parts does not guarantee metallurgical quality. We are discussing more specifically the importance to national defense of the use of the best metallurgical technique in the production of munitions of war. Nor is this the only type of equipment involved, because in a major war, the industrial machinery on the home front is vital. All industry will participate directly or indirectly in the industrial effort and any procedure which improves the efficiency of that effort will be in the interests of national defense.

A FRUITFUL field for exploitation is in the proper application and control of heat in the various metallurgical processes. In metal products we are concerned primarily with tensile and impact properties, hardness, ductility, fatigue, thermal conductivity, behavior toward corroding media and at the higher temperatures. These properties for any given composition are influenced by the application of heat in process of melting, de-oxidation, ingot and hot-working practice, and heat treatment.

Every application of heat, no matter how slight, will leave its mark for better or for worse; therefore, the importance of proper heat control to the uniformity of metals. I have spent much time and experienced considerable grief heat treating gun forgings in an effort to meet specifications only to have rejection from heat checks which had been set up previously both in the ingot and in the forging operations. I have seen high-grade uniform gun forgings ruined from the use of a hammer instead of a press. I have tested armor plate which was ballistically satisfactory in one spot and unsatisfactory in another one foot distant due to improper heat treatment. I have seen work spoiled—work in which many man hours of labor and many dollars had been invested—spoiled because of improper furnace loading or inadequate furnace equipment. It has been said that with the proper personnel any organization will function effectively. But it takes an excellent metallurgist and a resourceful heater to obtain satisfactory results from poor furnace equipment. Heat treatment to secure the greatest machinability obtainable with the composition at hand, and at the same time to meet the physical requirements demanded in ordnance, always will remain a vital problem in war production.

This may be illustrated well in shell-forging operations where capacity for heat treating by modern methods is totally inadequate. A shell is designed to do certain work at the target. If heat treatment fails to prepare the projectile for suitable fragmentation or desired penetration, the efficiency of artillery fire is reduced accordingly. When we consider the immense quantities of shell demanded in modern war, we realize that heat treatment easily may become a choke point in production. This suggests the utilization of shell steel of a composition which will give the desired physicals without heat treatment, and in certain respects, research in this direction is very encouraging.

Heat treatment of aluminum alloys, which are of special significance to the Air Corps, presents a somewhat similar and serious problem at the production plant. Only by careful control in both the heating and the cooling cycle can the qualities of uniformity, strength, and durability now demanded in ordnance and aëronautical equipment be assured.

THE Ordnance Department has and always will have many heating problems with which to contend. Some of these are common to industry. Heat checks attending the erosion of guns are not unusual in railway car wheels. Our welding problems are not basically different from similar problems in commercial welding. Cooling guns subjected to high-power rapid fire presents problems in metals similar to those before industry in matters of thermal conductivity. Industry contends with problems in fatigue which likewise exist in metals used in ordnance. Relative properties of metals at variable temperatures are of interest to both the Ordnance Department and industry.

Gun erosion, optimum shell fragmentation, machinability, cartridge brass, improved armor plate and armor-piercing projectiles, better gun steels, and improved welding, testing, and heat-treating methods, ferrous and nonferrous, are some of the fertile fields for physical and metallurgical research. There are many others. We need also much basic fundamental data both in the physical chemistry of steel making and in the field of physical metallurgy. Most of these problems are also industrial, but in certain cases we have specific fundamental problems, as in the determination of gun erosion and the mechanism of rupture of armor plate and projectiles. The closer we correlate our research and development work with industry, the surer are we to obtain satisfactory metals and shorten that vital transition period from M-day until industry is in mass production of essential items for the armed forces.

In conclusion, let me repeat that the Ordnance Department realizes the great importance of research and development to our national security. It attempts to capitalize not only on research provided by industry but also to utilize that provided through technical societies, college and university groups, other research organizations, and individuals with special technical knowledge. The increased complexity of military equipment, the huge quantities required, and the vital necessity for speed in production serve to emphasize the need for close correlation and application to ordnance of all data available. The ingenuity of the designer and the production manager also will be taxed to the utmost. Therefore, added emphasis must be placed upon projects leading to improved and simplified fabrication methods. This is one of the most promising ways in which to increase the war-time production rate. We must lean heavily upon the skill and facilities of private industry for research and for production engineering.

ARMY ORDNANCE

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Month by Month

EDUCATIONAL ORDERS FOR MILITARY ARMAment progressed several steps forward during the past month. First, the Congress made available, and the President approved, $14,250,000 for these orders. The complete program requested by the War Department is $32,500,000. Thus, funds for about one-half of the total program are at hand. A board of officers appointed last year and well qualified for such service has determined the priority of orders which will be included in the educational-orders program, and policies have been evolved to govern its administration.

Secondly, the Assistant Secretary of War, Hon. Louis Johnson, has appointed a committee of business men to review the entire educational-orders program and to recommend such objectives and methods of administration as will render these orders of greatest value. The chairman of the committee is Brig. Gen. Benedict Crowell, Assistant Secretary of War and Director of Munitions during the World War, and undoubtedly the country's leading exponent of industrial preparedness during the past twenty years. Members of the committee are: E. M. Allen, president, Mathieson Alkali Works, New York City; Carl L. Bausch, vice-president, Bausch & Lomb Optical Company, Rochester, N. Y.; Frank B. Bell, president, Edgewater Steel Company, Pittsburgh, Pa.; W. W. Coleman, president, Bucyrus-Erie Company, South Milwaukee, Wis.; Donald W. Douglas, president, Douglas Aircraft Company, Santa Monica, Calif.; John M. Hancock, Lehman Brothers, New York City; William S. Knudsen, president, General Motors Corporation, Detroit, Mich.; J. L. Perry, president, Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.; Charles J. Stilwell, vice-president, Warner & Swasey Company, Cleveland, Ohio; and L. A. Codd, editor of this journal.

Thus educational orders—long sought—are well on the way to practical operation. Six companies now are engaged on such orders under the authority of the act of June 16, 1938, whereunder $2,000,000 a year for five years was made available by the Congress. As previously announced, the critical items included in this earlier program and the companies which are at work on them are: the U. S. semi-automatic rifle M1, under contract to the Winchester Repeating Arms Company, New Haven, Conn.; the antiaircraft searchlight, to the General Electric Company, Schenectady, N. Y.; the recuperator for the 3-inch antiaircraft gun, to R. Hoe & Company, New York City; machining 75-mm. shell, to S. A. Woods Machine Company, Boston, Mass.; forging 75-mm. shell, to American Forge Company, Chicago, Ill.; the gas mask, to Goodyear Tire & Rubber Company, Akron, Ohio.

All students of industrial preparedness who have sponsored the educational-orders idea through many years will take heart not only that the program is a reality at last, but that its method of administration aims to achieve the very best results, first in the matter of education and secondly in the matter of reasonable relationships between industry and Government. Here is a program where mutuality of interest is of prime importance and the War Department is to be congratulated upon its determination to bring about fair and attractive conditions under which educational orders are to operate. In that spirit there can be no doubt that our national-defense policy has at last reached a period of its very greatest peace-time usefulness.

ON A BROADER FRONT, THE ECONOMIC PREparedness of the country advanced with the appointment of a peace-time counterpart of the War Resources Administration. It will be remembered that the industrial-mobilization plan anticipates a war-time coördinating body somewhat along the lines of the War Industries Board of the World War. Such a body will be known as the War Resources Administration. Its function will be the full coördination and utilization of the economic resources and industrial strength of the country for the winning of a war.

On August 9th, the Assistant Secretary of War, Mr. Johnson, and the Acting Secretary of the Navy, Hon. Charles Edison, jointly announced the formation of a War Resources Board. This announcement was made by the respective Secretaries in their capacities as joint chairmen of the Army and Navy Munitions Board. The War Resources Board will serve as a civilian advisory committee. The members of this new board are Edward R. Stettinius, Jr., chairman, United States Steel Corp.; Carl T. Compton, president, Massachusetts Institute of Technology; Walter S. Gifford, president, American Telephone & Telegraph Company; Harold G. Moulton, president, Brookings Institution; John Lee Pratt, director, General Motors Corporation; and Gen. Robert E. Wood, chairman, Sears Roebuck & Company. Col. Harry K. Rutherford, U. S. Army, director of the Planning Branch, Office of the Assistant Secretary of War, was designated to act as secretary of the War Resources Board.

In their announcement of these appointments, the two Secretaries called attention to the fact that the duties of the new board would consist in advising the Army and Navy Munitions Board on policies pertaining to the mobilization of the economic resources of the country in the event of a war emergency and in reviewing and perfecting the plans already under preparation by that agency. While the Army

and Navy Munitions Board is a peace-time operating agency of long standing, responsibility for it recently has been changed to the President direct instead of being on the Secretaries of War and Navy as formerly.

It also was pointed out by the Secretaries that in an emergency the War Resources Board would become an executive agency of the Government with broad powers similar to those of the old War Industries Board. In such event the board would report directly to the President as a war-resources administration. One of the first activities of the new board will be to consult with World War leaders, particularly those who were identified with the War Industries Board, in order that the advice and counsel of these distinguished gentlemen may be utilized to the maximum. The two Secretaries expressed themselves as deeply appreciative of the sacrifice of time and effort entailed on the part of those who have accepted membership on the board and indicated that they will be called upon to perform a service of the highest importance to the national welfare.

This new board has exceptional significance. Since the World War there have been two schools of thought in respect of a coördinating body to direct the power of the country in all its phases in time of war. One school holds that the actual appointment of such a body should await the imminence of war; the other school maintains that a war-resources administration should be in existence always in order that the transition from peace to war on the part of the entire country may be directed more expeditiously and more effectively by men who are conversant with its problems at all times. There are ample grounds to support both contentions, and there are worthy objections inherent in both.

After twenty years, however, opinion has indicated—and experience has shown—that war-resources administration is best attained as a continuing function of government. Probably the greatest factor in bringing about this view is the speed of modern life and therefore the velocities with which modern war can come.

Most convincing that such a step is warranted is the practice in England. Undoubtedly one of the greatest coordinating bodies for the utilization of national power is England's Committee of Imperial Defense. This committee exists always. Its composition is in a continual state of change. Its leadership rests directly upon the Prime Minister. Its members embrace not only ministers of all major offices but leaders in private life, the professions, industry, science and commerce. Here are gathered the control of the entire strength of the British Empire. Here are coördinated all the activities of the whole Government and people for the integration of national policy and national defense. The worth of this type of organization is being shown today in England in no uncertain terms.

The War Resources Board lacks many of the characteristics of the Committee of Imperial Defense. But it also embodies many of those characteristics. In so doing it will bring to us a type of peace-time coördination unknown in our experience. Not only the caliber of the men who will serve upon the War Resources Board but equally the military and naval experts who will assist them, and all others of the professions and industry who will be ready to help, indicate that the plans and studies which have been made for so many years are now given the added value of civilian advice. One might say in all truth that civilian coöperation with the military and naval authorities of the country in time of peace is the very base of national effectiveness in time of war. The War Resources Board and the Crowell Board can be two of the most far-reaching steps toward this most desirable end.

THE TWENTIETH ANNUAL MEETING OF THE Army Ordnance Association is announced elsewhere in this issue. With appropriate ceremonies this occasion will be observed in Washington on Wednesday, October 11th, and at the Aberdeen Proving Ground the following day, Thursday, October 12th. Both sessions of the meeting will be of unusual significance. It is the earnest hope of the officers and directors of the society that attendance both at Washington and Aberdeen will be in numbers commensurate with the anniversary.

This twentieth birthday comes at a time which even the founders of the industrial-preparedness movement in the United States could not have visualized. It finds their fellow countrymen intensely defense-minded—a condition not usual among the American people. It finds in operation a program, the like of which these same American people and their forebears previously have never undertaken in days of peace. It finds also a willingness on all sides to stimulate and encourage those ideas and ideals which—twenty years ago—were pioneer steps in the sphere of national defense.

The one outstanding achievement which the American people have applied for themselves as an outgrowth of the World War is industrial preparedness. Other peoples of other lands have done likewise. Those leaders in industrial countries who have neglected this very obvious element of defense have done so to the peril of themselves and their people. A fine sense of balance between military and industrial strength is now the acknowledged norm of national security. Men without munitions or, contrariwise, munitions without men are—either way—not a measure of safety. The two must be properly correlated.

But we in the United States, much to our own surprise, have taken this lesson to heart—sometimes with only meager relish, at other times with vibrant enthusiasm. Whatever the stages of this rise and fall, there can be no doubt that today the things with which men protect themselves in battle are the immediate concern of all our fellow citizens. The existence of these things in adequate quantity as well as their potential production in time of war are responsibilities which rank high on our national agenda.

That a patriotic body devoted to industrial preparedness—a society composed of executives, officers, and engineers in all walks of American life—should reach an important milestone in the midst of this renaissance is more than a commemorative occasion. It is quite unbelievable, judged by past experiences, that this mental attitude should have come about. But come about it has, so that when those of us who are pledged to the adequacy of our military defense and the permanency of industrial preparedness toward that end meet to mark the day, well may they reaffirm the principles of twenty years ago. Truth to tell, the present period of intensified progress will soon take its place as a milestone, while yet other unblazed trails will challenge exploration. On the twentieth anniversary of industrial preparedness in the United States we can look to the record of things done with some satisfaction. We must look to the uncharted course of things yet to be done with the same loyalty and devotion.

Preparedness Dangers

An Editorial

IN THESE days of our rearmament there are two striking dangers to the military preparedness of the United States. One is present overconfidence; the other is future undernourishment. By overconfidence is meant the attitude prevalent in many quarters that, in time of war, some one of the high command will merely push a button and start American industry going at full tilt on armament production. That sort of thing is a pipe dream, and a pipe dream it will remain no matter how efficient are our preparedness plans and our industrial readiness. By undernourishment is meant the attitude that what the American people are now spending on their military defense completes the job, and that two years hence, the current program finished, "we will be prepared" for any eventuality. That is a pipe dream too. Added to the other, these two fantasies are a nightmare from which we must shake ourselves awake at once.

Overconfidence as to things military is not new in our experience. Time and again, as the record shows, we have underestimated our military weaknesses by overestimating our strength. There are many classical examples, ancient and modern, to prove the point. Our most recent experience—that of the World War—will remain one of our greatest object lessons for many a day. The reports of the Chief of Ordnance from 1903 to 1914 are replete with the trials and tribulations of "educational orders" of those days, such as they were. The first decade and a half of the present century was a period of tremendous effort for the initial tooling for the shoulder rifle and the provision of equipment for the production of powder, time fuzes, field guns, and most other critical items of ordnance. But in spite of great energy and vision, the gigantic demands of the World War dwarfed the best forecasts of our thoroughly competent experts.

THIS thought was well expressed by Maj. Gen. C. M. Wesson, Chief of Ordnance of the Army, in a recent address before the Institute of Public Affairs at the University of Virginia. On this point General Wesson said: "We came out of the World War with perhaps the best equipped and best trained army the world has ever seen. It is true that the bulk of this equipment was of either French or British design. It is also true that much of it was manufactured abroad or taken over from American manufacturers who had produced for either France or England. Nevertheless the Regular Army and the National Guard were well equipped in 1919, and our storehouses were filled with reserve stores of armament supplies. We are always well prepared at the *end* of our wars, seldom at the *beginning*."

There have been many encouraging advancements beyond this state of affairs. As General Craig outlines elsewhere in this issue, our war-time requirements of arms, ammunition, and implements of war have been restated in realistic terms. We no longer calculate requirements in mythical figures; we compute them on sound and sane levels. Moreover, we have excellent current experience to guide our policies. The rearmament program in England, where an economy similar to our own prevails, has again emphasized that peace-time industry cannot become an efficient war-time industry in anything less than a year. If peace-time industry is severely out of touch, as it was in England, the time lag may be two years. And if political considerations intervene to impose added and unnecessary delays, nearly three years may be required for full efficiency. Remember that Britain's program of rearmament was begun in 1936. In 1939 her ministers serve notice that she is ready.

Our own experience is similar. We are now engaged on a sizable armament-production program. Again the common denominator is at least one year for the attainment of rounded production. But it is not by chance that funds for our current production and educational-orders program are allotted for 2-year periods. In time of peace, with the very best of coöperation on all sides, it takes nearly that length of time from the beginning to the successful completion of any major armament program—notwithstanding that we in the United States have had industrial preparedness as a national policy since 1920!

IT MAY seem strange to speak of undernourishing our military preparedness program at a time when we are engaged in the largest peace-time expenditures for our Army. There is no undernourishment *now* even though the present program provides less than half the deficiencies. The danger to which we refer is in the undernourishment which is bound to come. With the Army and Navy of the United States it is always a case of feast or famine. When the wave of economy comes—as come it must—it first lands squarely and heavily on our defense services. All the high-faluting enterprises of social reform—good, bad, and indifferent—continue on their merry way while strenuous demand is made for reductions in personnel, reductions in equipment, and even elimination of vital functions of defense—the most realistic of all Government responsibilities.

As the danger of undernourishment grows in coming years it will be folly of the first magnitude if the old theories of retrenchment again prevail. It will be criminal negligence if the defense forces—naval and military—are again compelled to watch their organizations disintegrate for lack of support and their equipment grow obsolete for lack of a sound, binding, continuing, alert national policy of readiness.

Our two preparedness dangers will be overcome if the American people in a realistic way recognize that time is always of the essence of defense. A month saved in war can mean the saving of a thousand lives and a half billion dollars. Thus in conscience our defense attitude must stem from a realism in which there is no false overconfidence and no artificial undernourishment. Our present experiences are making doubly apparent the truth that the realistic attitude of mind is as basic to sound national defense as are sufficiencies of men, money, and munitions. It would be well from the standpoint of national policy if there were general understanding now that despite our admirable industrial and man-power preparedness, this button-pressing business is a delusion and a snare. Our military leaders are doing their best to state the case accurately. Our people seem to be conscious of dangers that are explicit. It is incumbent upon them to understand those deeper dangers which are implied.

Association Affairs

Los Angeles Post

LIEUT. COL. R. L. MAXWELL, personal representative of the Chief of Ordnance of the Army, was the principal speaker at an industrial-preparedness meeting under the auspices of the Los Angeles Post, Army Ordnance Association, May 24, 1939. Donald Douglas, vice-president of the Post, presided in the absence of Earl B. Gilmore, president. The meeting was held at the Royal Palms Hotel.

"Ordnance Industry" was the title of Colonel Maxwell's address. He described the two major divisions of armament production in the United States; namely, the manufacturing arsenals—Government owned and operated establishments—on the one hand, and private industrial plants on the other. The former far outweigh the latter both in production and value of product in normal operations. He outlined also the plans and policies proposed for educational orders for armament. He described the steps now being taken to secure adequate mechanically trained personnel for aircraft production and maintenance. He urged that full support be given a movement for the creation of an industrial-defense reserve of skilled technicians for all phases of armament production.

Preceding his formal address, Colonel Maxwell read messages of greeting from Brig. Gen. Benedict Crowell, president of the Army Ordnance Association, from Maj. Gen. Charles M. Wesson, Chief of Ordnance of the Army, and from Hon. Louis Johnson, the Assistant Secretary of War.

Seated at the speakers' table with Mr. Douglas and Colonel Maxwell were: Lieut. Col. Harvey Burwell, commanding officer of the 19th Bombardment Group of March Field, Calif.; Maj. T. M. Jervey, Ordnance officer of March Field; Capt. C. B. Mayo, U.S.N., director of Naval Reserve affairs in Los Angeles; Col. H. Kobbe, commanding officer of the R.O.T.C. Units in Los Angeles; Lieut. Col. V. F. Bleasdale, inspector and instructor of the Marine Corps Reserve; M. A. Koffman, vice-president of the Los Angeles Chamber of Commerce and secretary and treasurer of the Southwestern Portland Cement Company; Brig. Gen. J. E. Fickel, commanding officer of the First Wing, GHQ Air Force of March Field; Col. R. B. Lincoln, commanding officer of March Field; and Glenn L. McDonough, member of the board of supervisors, Los Angeles County.

Arrangements for the meeting were directed by Maj. Ralph Cook Scott, Ord. Res., secretary of the Los Angeles Post, assisted by the other officers and directors who include: Lieut. Col. W. H. Adams, F. B. Cole, Maj. R. O. Cragin, H. S. Hitchcock, Lieut. Col. M. M. Mitchell, M. A. Koffman, and Samuel K. Rindge.

Hartford Ordnance District

THE Hartford Ordnance District held its fourteenth annual meeting at the Hotel Bond, Hartford, Conn., on the evening of May 25th with several hundred members in attendance. Col. B. A. Franklin, chief of the district, presided at the dinner which followed an afternoon meeting of the district's Advisory Board. The principal address at the dinner meeting was given by Maj. Gen. C. M. Wesson, Chief of Ordnance, who spoke on "Industry's Place in the Armament Program." General Wesson's address was received enthusiastically.

Emphasizing the present obligation of American industry generally in the armament program, General Wesson placed the Ordnance problem squarely before the representatives of this particularly ordnance minded industrial area. He described the various types of equipment which will be produced and then narrated the steps to be followed in actual procurement.

"The problem which confronts the Ordnance Department," General Wesson said, "is how to get this matériel. You know that normally the bulk of these articles is manufactured in Government arsenals, but the respective capacities of the six arsenals are entirely inadequate to take care of this program within the life of the appropriation; nor is it intended to increase them. We will, therefore, have to call upon industry. It is assumed that 75 per cent of the appropriation to which I have referred, approximately $150,000,000, will go either directly or indirectly to industry, and on this basis it will take over two years to complete the program, a fact in itself which indicates that we should start now without further delay in this most important national-defense program.

"I hope this program will have a beneficial effect on industry. We know it will have a beneficial effect on the arsenals. Having both industry and the arsenals manufacturing the same, or similar, items will be wholesome. The arsenals need competition for the same reasons that private industry does.

"The operations of the Ordnance Department are controlled from my office in Washington. The plans for the immediate program under discussion are now being prepared. My office is analogous to the general office of a large manufacturing corporation carrying on a diversified business. The execution of the plan will be decentralized through the medium of the six arsenals. To each of them will be assigned specific items to be contracted for by industry. The arsenals will issue the proposals and make the awards. Competitive bidding will govern. The bulk of the necessary inspection, however, will be done by the procurement district in which the work is being performed. During the past six months we have made substantial progress in building up the inspection organization in several of the districts. Our aim is prompt and intelligent inspection.

"Hartford is the headquarters of one of our most important procurement districts. The war load placed here is enormous. This occasion offers me the eagerly awaited opportunity publicly to thank Colonel Franklin, chief of the Hartford District, and Colonel Payne, assistant chief, for their unselfish and untiring efforts in planning for war-time production and for their great help in current procurement matters. I am satisfied that these gentlemen and their splendid corps of Reserve officers are prepared to administer the district in a highly satisfactory manner. I believe in the district system. We are counting upon it if trouble should come."

Col. Frederick H. Payne, vice-president of the Army Ordnance Association, chairman of the Association's Committee of Three Hundred on Twentieth Anniversary, and assistant chief of the Hartford Ordnance District, announced the award of the Franklin Medal to Maj. Clarence Colvin Stevens. This medal, founded in honor of Colonel Franklin, is awarded each year to the member of the district whose contributions to its advancement are adjudged worthy of so signal an award. Lieut. Col. L. A. Codd, executive secretary of the Army Ordnance Association, also spoke.

The following members of the Advisory Board of the district and of the district's Metallurgical Advisory Committee, were either in attendance or were represented at the meeting: *Advisory Board*—David Ayr, president, Hendey Machine Company; G. A. Bausman, president, National Equipment Company; F. R. Braman, vice-president, American Brass Company; C. R. Burt, president, Pratt & Whitney Division, Niles-Bement-Pond Company; C. C. Chesney, Pittsfield, Mass.; C. K. Davis, president, Remington Arms Company; P. B. Gale, chairman of the board, Hartford Machine Screw Company; J. H. Goss, president, Scovill Manufacturing Company; F. R. Hoadley, president, Atwood Machine Company; E. Kent Hubbard, president, Manufacturers Association of Connecticut; H. H. Pease, president, New Britain Machine Company; Edwin Pugsley, vice-president,

Winchester Repeating Arms Company; Col. J. D. Skinner, president, Fuller & Company; S. M. Stone, president, Colt's Patent Fire Arms Manufacturing Company; L. E. Underwood, works manager, General Electric Company; W. R. Webster, chairman of the board, Bridgeport Brass Company; R. H. Whitehead, president, New Haven Clock Company. *Metallurgical Advisory Committee*—D. K. Crampton, director of research, metallurgist, Chase Companies; H. J. Fischbeck, chief metallurgist, Pratt & Whitney Aircraft Division, United Aircraft Corporation; J. R. Freeman, Jr., technical manager, American Brass Company; W. B. Price, chief chemist, metallurgist, Scovill Manufacturing Company; W. R. Webster, chairman of the board, metallurgist, Bridgeport Brass Company.

CINCINNATI POST

THE rehabilitation of ordnance manufacturing arsenals was one of the principal topics in the address of Maj. Gen. C. M. Wesson, Chief of Ordnance of the Army, before the largest and most representative meeting in the history of the Cincinnati Post of the Army Ordnance Association held at the Queen City Club, Cincinnati, June 3, 1939. General Wesson was introduced by E. A. Muller, chief of the Cincinnati Ordnance District. L. W. Scott Alter, president of the Post, presided.

"Normally the bulk of the ordnance equipment required for our Initial Protective Force of 400,000 men would be manufactured in Government arsenals," General Wesson said, "but the respective capacities of the six arsenals are entirely inadequate to take care of this program within the life of the appropriation. . . . While we do not intend to increase the capacities of the arsenals, we do, however, intend to make full use of their existing facilities. Also, we sincerely hope to be able to replace with modern machine tools a substantial amount of the obsolete machinery with which these arsenals are now equipped. For this project $16,000,000 is required. The Congress has included in one of the three bills to which I have referred an item of $6,000,000 for this specific purpose. New and modern machine tools and equipment to be procured with this fund will materially aid the arsenals to efficiently perform their functions. The $6,000,000 will be distributed to the six manufacturing arsenals approximately as follows: Frankford, $877,500; Picatinny, $337,500; Rock Island, $1,282,500; Springfield, $1,012,500; Watertown, $1,215,000; Watervliet, $675,000.

"In connection with our war planning work we have estimated machine-tool requirements. These requirements are tremendous and, as far as we can see, will require more than the full capacity of the regular machine-tool industry. We feel, therefore, that we must have an ace in the hole for machining shell. We think we should have proved designs of single-purpose shell-machining tools. Some of these designs may be relatively complicated; others should be as simple as it is possible to make them. Whether simple or complicated, the component parts should be susceptible of manufacture by companies other than regular machine-tool builders. The Machine Tool Builders' Association is now assisting the Department to attain this objective by preparing designs of single-purpose shell-machining tools."

Other speakers on the program were: Brig. Gen. Benedict Crowell, president of the Army Ordnance Association; W. W. Tangeman, a director of the Association; Maj. Fred. A. McMahon, executive officer of the Cincinnati Ordnance District, and Lieut. Col. L. A. Codd, executive secretary of the Association. Among the honor guests were Frank B. Bell, chief of the Pittsburgh Ordnance District, in addition to the directors of the local chapter who include R. K. LeBlond, B. B. Quillen, Lieut. Col. A. H. Pugh, S. M. Rowe, J. T. Faig, Lieut. Col. S. G. Kuhn, and Lieut. Col. A. W. Lissauer. In the recent growth of the Post, in which many members have participated, August H. Tuechter has taken an especially active and successful part. He is a charter member both of the Association and of the local Post.

CHICAGO POST

AN informal meeting of the Chicago Post, Army Ordnance Association, was held during the late afternoon of July 25th at the Palmer House, Chicago. The occasion was an exhibit of the new 60-mm. trench mortar, the new 37-mm. antitank gun, and the semiautomatic rifle M1. The exhibit was received with a great deal of interest by the members of the Post and their guests.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY POST

THE Massachusetts Institute of Technology Post of the Army Ordnance Association had one of its most active seasons during the last scholastic year, this despite the fact that severe academic requirements at M.I.T. necessarily limited all extracurricular activities. The fine record of the group for the year 1938-1939 was due to the united interest of all members under the leadership of Cadet Lieut. George R. Weinbrenner, president of the Post, and Maj. H. A. Nisley, Ord. Dept., who is in charge of the Ordnance Unit, R.O.T.C.

During the winter months, regularly scheduled meetings of the Post were featured by War Department films on tactical and technical subjects. A visit of inspection was made to the Watertown Arsenal which was of particular interest to those students pursuing the mechanical-engineering and metallurgical courses. An inspection trip was also made to the defenses of Boston Harbor.

Student members of the Post were prominent in the R.O.T.C. regiment. The two cadet lieutenant colonels, Manning Morrill and Alphonse Graffeo, were members of the Ordnance Unit, as also were three cadet majors, Morris Nicholson, Winthrop Reed, and Harold Seykota.

ORDNANCE SCHOLARSHIP KEYS

FIRST awards of Army Ordnance Association scholarship keys for the year 1939 were made at University of Cincinnati. The keys were presented to members of the junior and prejunior classes of the Ordnance Unit, Reserve Officers' Training Corps. The presentation was a feature of the annual officers' ball of the R.O.T.C. Unit. The award for the junior class, known as the Army Ordnance Association Medal, was presented by E. A. Muller, chief of the Cincinnati Ordnance District, to Cadet Capt. John J. Ritchie, Jr. The award for the prejunior class, known as the Cincinnati Ordnance District Medal, was presented by L. W. Scott Alter, president of the Cincinnati Post, Army Ordnance Association, to Cadet Sgt. Paul D. Menefee. Maj. James W. Walters, Ord. Dept., is in charge of the Ordnance Unit at the University of Cincinnati.

At University of California, the Association's Ordnance scholarship keys were awarded to Joseph Keith Kellogg of Long Beach, Calif., senior cadet, and to George Frederic Switzer of Oakland, Calif., junior cadet. The awards were made by President Robert G. Sproul before the assembled military and naval R.O.T.C. Units at the annual President's Review and were witnessed by a group of distinguished officials and a large number of civilian visitors. Capt. Otto M. Jank, Ord. Dept., is on duty with the R.O.T.C. Ordnance Unit at California.

At Georgia School of Technology, the scholarship keys were awarded to Paul E. Atwood of the senior class and to Horace W. Bronson, Jr., of the junior class. All the graduates of the Ordnance Unit attended training camp at the Aberdeen Proving Ground from June 10th to July 25th. Capt. E. C. Franklin, Ord. Dept., is on duty with the Ordnance Unit at Georgia Tech.

At Lehigh University, keys were presented to Ashley C. Worsley, a senior in chemical engineering and to William B. Pohlman, a junior in engineering physics. Mr. Worsley is a native of New Jersey and prepared for Lehigh at Collingswood

High School in that state. Mr. Pohlman came to Lehigh from Little Falls, N. J. The awards were made at the annual field day before the entire R.O.T.C. Regiment by Col. J. S. Leonard, Inf. The regiment was commanded by an Ordnance student, Cadet Col. Courtland F. Carrier, III, of White Plains, N. Y. Maj. T. C. Gerber, Ord. Dept., who was on duty with the Ordnance Unit until June 1939, has been succeeded by Capt. B. S. Mesick, Ord. Dept.

At Massachusetts Institute of Technology, the Ordnance scholarship keys were awarded to Cadet Capt. Richard S. Leghorn, senior class, and Cadet William R. Taylor, Jr., junior class. These awards were made at a special regimental ceremony by Col. C. E. Fuller, of the Mechanical Engineering Department. Cadet Lieut. Col. Alphonse J. Graffee of the R.O.T.C. Ordnance Unit was awarded a gold medal by the Massachusetts Society of the Sons of the American Revolution for outstanding accomplishment in both the military and academic requirements for the advanced course, R.O.T.C. Maj. H. A. Nisley, Ord. Dept., is on duty with the Ordnance Unit at M.I.T.

At Cornell University, keys were won by James J. Wilder and Udo W. Fischer, both seniors in the Ordnance Unit. The basis of award was the highest average grade in the three major Ordnance subjects of their course—ammunition, matériel, and field service. Mr. Wilder, a senior in mechanical engineering, comes from Rochester, N. Y. Mr. Fischer, also a senior in mechanical engineering, is from Mount Airy, Pa. In addition to these awards, Noah E. Dorius, of the second year advanced course, Ordnance Unit, was designated an honor graduate in accordance with Army Regulations, having been chosen by the president of the university for scholastic excellence and by the professor of military science and tactics as possessing outstanding qualities of leadership, character, and aptitude for military service. William C. Chandler, also of the advanced course, Ordnance Unit, was presented with a gold medal awarded by the Empire State Society of the Sons of the American Revolution for leadership, soldierly bearing, and excellence in theoretical and practical work of the course. William H. Habicht of the first year advanced course, Ordnance Unit, having been selected as the outstanding member of his branch, was presented with a saber to be held during the senior year awarded by Company C of the Scabbard and Blade.

At Stanford University the Association's scholarship keys were presented to Cadet Lieut. Will W. Lee and Cadet Lieut. Robert R. Matheu by Lieut. Gen. Albert J. Bowley, commanding general of the Ninth Corps Area, at the annual inspection review. Maj. Joel G. Holmes, Ord. Dept., is on duty with the Stanford Ordnance Unit.

At University of Oklahoma the keys were won by George T. Holland, Ordnance Unit, a senior in the advanced course, and William M. Craig, a junior in the advanced course. Mr. Holland is a native of Mount Pleasant, Tex.; he chose natural-gas engineering as his major subject. Mr. Craig, from Oklahoma City, majored in physics. Capt. W. J. Crowe, Ord. Dept., is on duty with the Ordnance Unit at Oklahoma.

"Notes on United States Ordnance, 1776-1938"

CAPT. JAMES E. HICKS of Mount Vernon, N. Y., has announced that "Small Arms," the first volume of "Notes on United States Ordnance, 1776-1938," is now in preparation. The volume, with illustrations by Andre Jandot, will contain hundreds of line cuts showing all types of arms—both exterior and sectionalized views. The volume will reproduce many original letters relating to early U. S. military weapons. Original sheets, listing the contractors of 1798, with notations made later as to the delivery of each parcel of arms, also will be reproduced as will one of the original contracts of 1798 together with a receipt for the pattern musket, given at the consummation of the contract. The price of the volume will be $4.50.

Ordnance Cadets Honored

CADET R. B. STAVER, *2726* Alameda Drive, Portland, Ore., and Cadet R. K. Weyand, 563 East 13th Street, San Leandro, Calif., were recipients of honors at the Ordnance R.O.T.C. Camp at Fort Lewis, Wash. The camp was held from June 17th to July 28th. Both cadets had the distinction of highest scores in the pistol and rifle courses.

Lieut. Col. Welton J. Crook, Spec. Res., who was on duty at the camp, presented 1-year subscriptions for ARMY ORDNANCE to both honor men. In extending congratulations to these expert shots, thanks also go to Colonel Crook for his thoughtfulness.

General Spaulding to Lecture

BRIG. GEN. OLIVER L. SPAULDING, outstanding authority on the military history of the United States and a contributor to ARMY ORDNANCE, has been appointed to the faculty of George Washington University as a professorial lecturer and next year will give a seminar in the military history of the United States.

The seminar will cover a study of the background, development, relations to the civil government and larger implications of the American military system; the relationship of war to the economic and social life of the nation; and war as a component part of the national experience. Enrollment will be restricted to a small number of selected students having the historical background and a special interest in the subject.

General Spaulding, who was chief of the historical section of the Army War College, is both a scholar and a military expert. He is the author of the standard history of the United States Army and of works on European warfare. He holds the degrees of A.B. from the University of Michigan, A.M. and LL.B. from Harvard, and is a graduate of the Army War College and honor graduate of the Artillery School.

He has served as professor of military science at Harvard and as lecturer at the Lowell Institute, Boston. He wears the Distinguished Service Medal, is a Commander of the Order of the Black Star of France, and holds various campaign medals.

New Members

DURING the period June 1, to July 31, 1939, inclusive, the following applicants were admitted to membership in the Army Ordnance Association: Julius Ochs Adler, New York, N. Y.; Victor A. T. Albright, Bedford, Ind.; Blas A. Alejandre, Aberdeen Proving Ground, Md.; Carl G. Allgrunn, Middleport, N. Y.; Alfred Altman, New York, N. Y.; E. J. Anderle, Dayton, Ohio; J. A. Anderson, Cincinnati, Ohio; Richard Anderson, San Francisco, Calif.; O. B. Andrews, Jr., Chattanooga, Tenn.; W. H. Arnold, Springfield, Ohio; Wm. T. Ashcroft, Stratford, Conn.; David F. Austin, Pittsburgh, Pa.

Earl D. Bader, Cincinnati, Ohio; George Baekeland, New York, N. Y.; William W. Barton, Rockford, Ill.; F. H. Bedford, Jr., New York, N. Y.; Samuel L. Belknap, Los Angeles, Calif.; Samuel L. Belknap, Jr., Los Angeles, Calif.; Vincent Bendix, New York, N. Y.; S. E. Bergstrom, Cincinnati, Ohio; W. H. Bickford, Dayton, Ohio; Robert Bierbaum, Cincinnati, Ohio; George W. Bird, Springfield, Ohio; James M. Bisbee, Brooklyn, N. Y.; E. Lawton Bishop, East Syracuse, N. Y.; C. F. Black, Dayton, Ohio; Julius G. Bossert, Cincinnati, Ohio; E. H. Bostick, Amite, La.; Edward W. Bradshaw, Beggs, Okla.; V. J. Bramlage, Middletown, Ohio; Everett M. Breed, San Francisco, Calif.; Ray S. Brill, Washington, D. C.; Leroy Brooks, Jr., Cincinnati, Ohio; Allen Brown, New York, N. Y.; Henry P. Burgarde, II, Buffalo, N. Y.; Daniel G. Burkert, Boyertown, Pa.

J. Thomas Camlet, Clifton, N. J.; James H. Carnine, Indianapolis, Ind.; M. A. Carpenter, Milwaukee, Wis.; O. W. Carpenter, Jr., Milwaukee, Wis.; Wesley C. Casson, Birmingham,

Mich.; William C. Chandler, Brooklyn, N. Y.; F. L. Chapman, Madison, Wis.; J. H. Chasmar, Bridgeport, Conn.; Ernest W. Clark, Hartford, Conn.; George M. Class, Madison, Wis.; Frank C. Coe, Philadelphia, Pa.; Aaron Cohn, Philadelphia, Pa.; E. A. Coombs, Madison, Wis.; James W. Costello, Los Angeles, Calif.; J. B. Craig, Bellefonte, Pa.; Alfred F. Crone, Buffalo, N. Y.; A. E. Cullen, Clayton, Mo.

A. J. Davis, St. Louis, Mo.; Albert R. Davis, II, South Euclid, Ohio; Alfred C. Davis, Jamestown, N. Y.; Robert J. Davis, Cleveland, Ohio; Rodney N. Davis, Philadelphia, Pa.; N. E. Dawson, Los Angeles, Calif.; Lawrence E. Denman, Cincinnati, Ohio; Lester G. Detterbeck, Chicago, Ill.; William L. Dolle, Cincinnati, Ohio; Henry R. Dorney, Baltimore, Md.; F. E. Duckwall, Indianapolis, Ind.; Thomas P. Durell, New York, N. Y.; George L. Dyer, St. Louis, Mo.

Murray Earle, Philadelphia, Pa.; Edward F. Entwisle, Lackawanna, N. Y.; Irving N. Esleeck, Greenfield, Mass.; Herman K. Ewig, Cincinnati, Ohio. Sherman M. Fairchild, New York, N. Y.; R. S. Falk, Milwaukee, Wis.; Charles W. Ferguson, Dallas, Tex.; Udo W. Fischer, Philadelphia, Pa.; Charles R. Fondersmith, Middletown, Ohio; James R. Forgan, New York, N. Y.; Robert E. Fosdick, Dayton, Ohio; Douglas W. Franck, Lancaster, Pa.; Robert Frankl, Cincinnati, Ohio; Ralph L. Freeman, Chicago, Ill.

Don C. Gardner, Cincinnati, Ohio; Philip O. Geier, Cincinnati, Ohio; J. S. George, Waterbury, Conn.; Carl K. Gieringer, Cincinnati, Ohio; Charles E. Gilbert, Cincinnati, Ohio; Frank P. Gilligan, Hartford, Conn.; Mitchell J. Glick, Ridley Park, Pa.; Robert J. Granberg, Prince Bay, S. I., N. Y.; Charles M. Green, Ilion, N. Y.; H. Green, Milwaukee, Wis.; Frank V. Grennor, Chicopee, Mass.; H. O. Gummere, Dayton, Ohio.

John W. Haddock, Michigan City, Ind.; Arthur H. Hall, Philadelphia, Pa.; Donald A. Hall, Portland, Ind.; Charles J. Hardy, New York, N. Y.; F. P. Harrigan, Newark, N. J.; Harold B. Harvey, Chicago, Ill.; Edwin B. Hausfeld, Cincinnati, Ohio; William A. Hayes, Springfield, Mass.; Walter T. Hazel, Marietta, Ohio; William C. Heindel, Cincinnati, Ohio; William Henderson, Wauwatosa, Wis.; L. Henig, Du Bois, Pa.; Gustave A. Heuser, Louisville, Ky.; Lockwood Hill, St. Louis, Mo.; C. L. Holden, Kings Mills, Ohio; Robert O. Holmes, Zanesville, Ohio; Nevil M. Hopkins, New York, N. Y.; Howard M. Hubbard, Cleveland, Ohio; L. D. Heustis, Portsmouth, Ohio. Littleton Jackson, Washington, D. C.; George H. Jacobs, Kings Mills, Ohio; J. P. Jefferis, Dover, Ohio; Albert M. Johnson, Rockford, Ill.; Francis R. Juan, Aberdeen Proving Ground, Md.

Frank J. Kahrs, Verona, N. J.; Harold M. Karet, Buffalo, N. Y.; Benjamin I. Kaufman, Cincinnati, Ohio; Joseph K. Kellogg, Long Beach, Calif.; Walter Kelsey, Tarrytown, N. Y.; J. D. Kennedy, Chattanooga, Tenn.; Benjamin W. Kerr, Greensburg, Pa.; Frank D. Kirk, Wauwatosa, Wis.; Harold R. Klein, New York, N. Y.; Paul S. Knowles, Milwaukee, Wis.; B. Koch, Wauwatosa, Wis.

Everett D. Landen, Brimfield, Mass.; William P. Langhammer, Springfield, Mass.; Frank Latenser, Omaha, Nebr.; Albert G. Lauzon, Dayton, Ohio; F. D. Layton, Hartford, Conn.; John K. Lencke, Kingston, N. Y.; Mitchell S. Little, Hartford, Conn.; H. E. Lockwood, Cincinnati, Ohio; Richard Lopez, Astoria, L. I., N. Y.; Aubrey L. Lowe, Ilion, N. Y.; Kenneth J. Lowe, Ilion, N. Y.; John E. Lynch, Cincinnati, Ohio; Daniel A. Lyons, Los Angeles, Calif.

William L. MacRae, Syracuse, N. Y.; Thomas D. Maher, Castle Point, N. Y.; Philip S. Malickson, Bala, Pa.; Frank W. Manegold, Chicago, Ill.; J. M. Manley, Cincinnati, Ohio; Frank Marriott, St. Louis, Mo.; George E. McGuire, Lewiston, N. Y.; G. K. McKee, Covington, Ky.; Richard A. McLaughlin, Canton, Ohio; John W. McMurray, Nashville, Tenn.; Samuel Morrison, Buffalo, N. Y.; Harold F. Mossberg, Hamden, Conn.; Iver O. Mossberg, New Haven, Conn.; Robert E. Mullane, Cincinnati, Ohio; D. Hayes Murphy, Hartford, Conn.

George Nagengast, Fords, N. J.; Constantine N. Neklutin, Normandy, Mo.; L. F. Nenninger, Cincinnati, Ohio; Albert Neukom, Toledo, Ohio; L. E. Neville, New York, N. Y.; John B. Nickels, Dayton, Ky. William C. Oberg, Pittsburgh, Pa.; Fred Ochsenbein, Omaha, Nebr.; Mancil E. Orereen, Vicksburg, Miss.; Fred Organ, Omaha, Nebr.

Russell Palmer, Altadena, Calif.; B. B. Patten, Chicago, Ill.; D. A. Patterson, Covington, Ky.; Judd Payne, New York, N. Y.; Walter L. Pierson, New Haven, Conn.; George E. Pinckney, Bridgeport, Conn.; F. A. Pritzlaff, Wauwatosa, Wis.; William A. Purtell, West Hartford, Conn.

E. G. Rahe, Cincinnati, Ohio; David H. Ray, Arcadia, Calif.; L. John Ray, Adrian, Mich.; R. J. Redmond, Cincinnati, Ohio; Ralph G. Rehor, Cleveland, Ohio; W. U. Reisinger, Bridgeport, Conn.; Peter E. Rentschler, Hamilton, Ohio; Eugene S. Rich, Hamilton, Ohio; George W. Richards, II, Upper Darby, Pa.; R. H. Ritchie, Chicago, Ill.; Harold P. Ritter, Cincinnati, Ohio; Jerry G. Rizzo, New York, N. Y.; Louis G. Robinson, Cincinnati, Ohio; Millard Romaine, Cincinnati, Ohio; Philip W. Root, Pittsburgh, Pa.; Frank L. Ross, Portland, Ore.; L. M. Rossi, New York, N. Y.; William H. Roth, Philadelphia, Pa.; William B. Ruger, Greensboro, N. C.

Raymond R. Sawin, New Haven, Conn.; Carl O. Schmidt, Jr., Cincinnati, Ohio; W. P. Schmitter, Milwaukee, Wis.; W. Schneider, Wauwatosa, Wis.; Fred Schoeffler, Loveland, Ohio; E. M. Schumo, Hamburg, Pa.; Louis Schwitzer, Indianapolis, Ind.; William R. Scott, Ridgewood, N. J.; W. I. Senger, Madison, Wis.

Oscar L. Shafer, Cincinnati, Ohio; Oscar F. Shepard, Cincinnati, Ohio; J. C. Shouvlin, Springfield, Ohio; Roy R. Siegel, St. Louis, Mo.; Kurt Siems, Cincinnati, Ohio; Daniel Simonds, Lockport, N. Y.; W. A. Slater, Pittsburgh, Pa.; C. E. Smith, Elmira, N. Y.; W. Cordes Snyder, Jr., Sewickley, Pa.; Lennard C. Sorensen, Cincinnati, Ohio; Edward L. Soule', San Francisco, Calif.; L. P. Sperry, Waterbury, Conn.; M. L. Sperry, Jr., Waterbury, Conn.; Arthur Stanworth, Lebanon, Ind.; Henry R. Stegeman, Fort Thomas, Ky.; Edward H. Stettinius, Jr., New York, N. Y.; F. E. Stoller, Cleveland Heights, Ohio; B. E. Strader, Bridgeport, Conn.; David M. Strauchen, Cincinnati, Ohio; C. K. Swafford, Madison, Wis.; Roy C. Swan, Scarsdale, N. Y.; Howard N. Sweetman, Indianapolis, Ind.

Edward J. Tate, Buffalo, N. Y.; Thomas R. Tate, Washington, D. C.; Bernard A. Thomas, Tampa, Fla.; Ralph E. Thompson, Brookline, Mass.; C. Todd, Ampere, N. J.; Norman B. Tompkins, Baltimore, Md.; Theodore Trecker, Milwaukee, Wis.; F. G. Troisi, Pittsburgh, Pa.; Frederick J. Trumpour, Forest Glen, Md.; Edward D. Uhlendorf, Chicago, Ill.; Francis J. Van Poppelen, Ilion, N. Y.; K. E. Vogel, Omaha, Nebr.

David J. Walsh, Rahway, N. J.; Herbert W. Weber, Pittsville, Pa.; Clyde B. Wells, Bridgeport, Conn.; Walter H. Wenzel, Milwaukee, Wis.; Tage F. Werme, Fairfield, Conn.; Arthur Wernsten, Chicago, Ill.; Seth Wheeler, Jr., Albany, N. Y.; James R. White, New York, N. Y.; Arthur Wild, Detroit, Mich.; J. Wilkinson, Milwaukee, Wis.; William R. Willard, Willimantic, Conn.; Horatio B. Williams, Woodstock, N. Y.; Othneil G. Williams, Winsted, Conn.; N. R. Wilson, New York, N. Y.; John F. Winchester, New York, N. Y.; Carl J. Winkler, Lebanon, Ind.; T. N. Wood, Wilkes-Barre, Pa.; F. B. Yingling, Hamilton, Ohio; Lafayette Young, Alton, Ill.; C. A. Zoller, Jr., Washington, D. C.

NECROLOGY

NOTICE has been received of the death of the following members of the Association: William M. Austin, Yonkers, N. Y.; Charles H. Grant, Englewood, Fla.; Fred Key, East St. Louis, Mo.; Harold R. Noren, Loch Raven, Md., and Lars H. Vold, Butler, Pa. To their relatives and friends ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

Ordnance Gazette

The following is a roster of officers of the Ordnance Department of the Army, with their stations. Customary changes at this season of the year make it difficult to keep currently informed about friends and acquaintances in the Regular service. Hence the list, corrected to August 1, 1939, is published for the information of members of the Army Ordnance Association.

OFFICERS OF THE ORDNANCE DEPARTMENT, UNITED STATES ARMY

CHIEF OF ORDNANCE.....MAJ. GEN. CHARLES M. WESSON
ASSISTANTS TO THE CHIEF OF ORDNANCE.....BRIG. GEN. EARL MCFARLAND
BRIG. GEN. CHARLES T. HARRIS, JR.

Adamson, Keith F., Lieut. Col., Ordnance Office, Washington, D. C.
Allen, Charles K., 1st Lieut., Fort Devens, Mass.
Aman, Joseph L., Maj., Hq. Eighth Corps Area, Fort Sam Houston, Tex.
Armitage, John D., 1st Lieut., Aberdeen Proving Ground, Md.
Armstrong, Donald, Lieut. Col., Chicago Ordnance District, 1117 New Post Office Building, Chicago, Ill.
Atwood, Frank J., Lieut. Col., Fort Knox, Ky.
Aurand, Henry S., Lieut. Col., Army Industrial College, Washington, D. C.
Baird, Arthur R., Maj., (Hq. Ninth Corps Area) 409 Chamber of Commerce Building, Los Angeles, Calif.
Baker, James O., 1st Lieut., Aberdeen Proving Ground, Md.
Bandholtz, Cleveland H., Lieut. Col., Army War College, Fort Humphreys, Washington, D. C.
Barclay, John A., Jr., 1st Lieut., Corozal, C. Z.
Bardsley, George H., Capt., U. S. Military Mission, American Embassy, Rio de Janeiro, Brazil.
Barnard, Clarence, Maj., San Antonio Arsenal, San Antonio, Tex.
Barnes, Gladeon M., Lieut. Col., Ordnance Office, Washington, D. C.
Barr, Robert S., Lieut. Col., Honolulu, T. H.
Barroll, M. K., Jr., Maj., Ordnance Office, Washington, D. C.
Barry, Edwin F., Maj., Watertown Arsenal, Watertown, Mass.
Bassett, Ralph H., Capt., Hamilton Field, Calif.
Becker, Ward E., Maj., Army Industrial College, Washington, D. C.
Bell, William L., Jr., Capt., U. S. Military Academy, West Point, N. Y.
Bellinger, John B., Maj., Fort Benning, Ga.
Beyma, Severin R., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Billingsley, John D., Capt., Ordnance Field Service School, Raritan Arsenal, Metuchen, N. J.
Blackmore, Philip G., Lieut. Col., Cleveland Ordnance District, 1524 Keith Building, Cleveland, Ohio.
Boatwright, W. P., Col., Frankford Arsenal, Philadelphia, Pa.
Bodeau, Edward, 1st Lieut., Mitchel Field, Hempstead, Long Island, N. Y.
Bodine, Robert N., Lieut. Col., Ordnance Office, Washington, D. C.
Bomar, Ernest C., Maj., Frankford Arsenal, Philadelphia, Pa.
Booth, Lucian D., Col., Ordnance Office, Washington, D. C.
Booton, John G., Lieut. Col., San Antonio Arsenal, San Antonio, Tex.
Borden, William A., Lieut. Col., (Staff) Army Industrial College, Washington, D. C.
Bowlin, Roy L., Maj., Rochester Ordnance District, 1118 Mercantile Building, Rochester, N. Y.
Breakefield, Durward E., 1st Lieut., Watertown Arsenal, Watertown, Mass.
Breen, John J., Capt., Springfield Armory, Springfield, Mass.
Bricker, Edwin D., Col., Frankford Arsenal, Philadelphia, Pa.
Bricker, L. Monroe, Maj., Fort Mills, P. I.
Broberg, Waldemar S., Capt., Philadelphia Ordnance District, 1417 Mitten Building, Philadelphia, Pa.
Brooks, John A., Jr., Lieut. Col., Ordnance Field Service School, Raritan Arsenal, Metuchen, N. J.
Brown, John E., Maj., Delaware Ordnance Depot, Pedricktown, N. J.
Brown, Percy H., Jr., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Buck, Champlin F., Jr., 1st Lieut., Watertown Arsenal, Watertown, Mass.
Burns, James H., Col., Office of the Assistant Secretary of War, Washington, D. C.
Butler, Robert G., Jr., Capt., U. S. Military Academy, West Point, N. Y.
Buyers, Archie S., Lieut. Col., Picatinny Arsenal, Dover, N. J.
Cabell, De Rosey C., Lieut. Col., Aberdeen Proving Ground, Md.
Cain, James A., Jr., 1st Lieut., Fort Knox, Ky.
Call, William A., 1st Lieut., Honolulu, T. H.
Campbell, Harry L., Maj., Charleston Ordnance Depot, Charleston, S. C.
Campbell, Levin H., Jr., Lieut. Col., Frankford Arsenal, Philadelphia, Pa.
Capron, Webster A., Col., Honolulu, T. H.
Case, Rolland W., Col., Watertown Arsenal, Watertown, Mass.
Chatfield, Miles B., 1st Lieut., Frankford Arsenal, Philadelphia, Pa.
Chavin, Raphael S., Maj., Picatinny Arsenal, Dover, N. J.
Childs, Jefferson D., 1st Lieut., Raritan Arsenal, Metuchen, N. J.
Christmas, John K., Maj., Aberdeen Proving Ground, Md.
Churchill, Harold W., Maj., Ordnance Office, Washington, D. C.
Clark, Thomas A., Col., Rock Island Arsenal, Rock Island, Ill.
Clay, Wallace L., Col., Frankford Arsenal, Philadelphia, Pa.
Clement, John K., Lieut. Col., New York Ordnance District, 90 Church Street, New York, N. Y.
Coffey, John W., Maj., Army War College, Fort Humphreys, Washington, D. C.
Colby, Joseph M., Capt., Command and General Staff School, Fort Leavenworth, Kans.
Collins, Everett, Lieut. Col., Hq. Fifth Corps Area, Fort Hayes, Columbus, Ohio.
Conner, Steven L., Capt., Watervliet Arsenal, Watervliet, N. Y.
Conway, Harold J., Capt., Aberdeen Proving Ground, Md.
Coombs, Raymond H., Capt., Rock Island Arsenal, Rock Island, Ill.
Coupland, Richard C., Maj., Ordnance Office, Washington, D. C.
Cowhey, Joseph L., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Cozart, Clarence A., 1st Lieut., Raritan Arsenal, Metuchen, N. J.
Crain, James K., Col., Ordnance Office, Washington, D. C.
Crane, Richard Z., Maj., Detroit Ordnance District, 611 Federal Building, Detroit, Mich.
Crawford, David J., Capt., Aberdeen Proving Ground, Md.
Crawford, James S., Maj., Boston Ordnance District, 2004 Post Office Building, Boston, Mass.
Crim, Lemuel P., Maj., Savanna Ordnance Depot, Savanna, Ill.
Crowe, William J., Capt., (R.O.T.C.) University of Oklahoma, Norman, Okla.
Crump, Ira A., Maj., (R.O.T.C.) University of Michigan, Ann Arbor, Mich.
Cummings, Emerson L., Capt., Army Industrial College, Washington, D. C.
Custis, Arthur B., Maj., Barksdale Field, Shreveport, La.

Cyr, Arthur R., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Daniel, Samuel A., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Daniels, Robert W., Lieut. Col., Fort Bliss, Tex.
Darby, Marshall E., Capt., National Guard Bureau, Washington, D. C.
Davis, Merle H., Maj., Ordnance Office, Washington, D. C.
De Guire, Merlin L., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Deitrick, Carroll H., Capt., Picatinny Arsenal, Dover, N. J.
Del Campo, Angelo R., Jr., 1st Lieut., Fort Sam Houston, Tex.
D'Espinosa, William J., Capt., Ordnance Office, Washington, D. C.
Devenbeck, Floyd C., Capt., Corozal, C. Z.
Deylitz, Paul L., Capt., Rock Island Arsenal, Rock Island, Ill.
Dillon, Leo J., Maj., Army Industrial College, Washington, D. C.
Dishman, Addison V., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Donald, Walter G., Capt., Ordnance Office, Washington, D. C.
Drewry, Guy H., Maj., Ordnance Office, Washington, D. C.
Dutton, Carl R., Capt., Picatinny Arsenal, Dover, N. J.
Eddy, George G., Capt., Aberdeen Proving Ground, Md.
Elliot, Arthur D., Maj., Edgewood Arsenal, Edgewood, Md.
Elliott, Stewart H., Maj., Fort Monroe, Va.
Englehart, Francis A., Lieut. Col., Hq. Fourth Corps Area, Post Office Building, Atlanta, Ga.
Faymonville, Philip R., Lieut. Col., Ordnance Office, Washington, D. C.
Fletcher, Leslie S., Capt., Frankford Arsenal, Philadelphia, Pa.
Ford, Arthur W., Lieut. Col., Picatinny Arsenal, Dover, N. J.
Ford, Elbert L., Maj., Springfield Armory, Springfield, Mass.
Frank, Selby H., Lieut. Col., San Juan, P. R.
Franklin, Edward C., Capt., (R.O.T.C.) Georgia School of Technology, Atlanta, Ga.
Freeman, James W., Capt., Hq. Seventh Corps Area, Federal Building, Omaha, Nebr.
Gatchell, Oscar J., Lieut. Col., U. S. Military Academy, West Point, N. Y.
Gaugler, Roland L., Lieut. Col., Manila, P. I.
Gerber, Theodore C., Maj., Watertown Arsenal, Watertown, Mass.
Gerhardt, William R., Maj., Command and General Staff School, Fort Leavenworth, Kans.
Gibson, James A. B., Maj., Manila, P. I.
Gilbert, Fred I., Maj., Honolulu, T. H.
Gillespie, Alexander G., Col., Ordnance Office, Washington, D. C.
Gillon, Paul N., 1st Lieut., Aberdeen Proving Ground, Md.
Goebert, Elmer C., Maj., Rock Island Arsenal, Rock Island, Ill.
Gorton, Walter T., Maj., Springfield Armory, Springfield, Mass.
Gray, Edward, 1st Lieut., Aberdeen Proving Ground, Md.
Gruver, Earl S., Capt., Command and General Staff School, Fort Leavenworth, Kans.
Guion, James L., Maj., Pittsburgh Ordnance District, 1046 New Federal Building, Pittsburgh, Pa.
Hall, Dale C., Maj., Hq. Ninth Corps Area, Presidio of San Francisco, Calif.
Hamilton, Walter C., Maj., Philadelphia Ordnance District, 1417 Mitten Building, Philadelphia, Pa.
Hannum, Reiff H., Lieut. Col., Ordnance Office, Washington, D. C.
Hansen, Floyd A., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Hardigg, William B., Lieut. Col., Curtis Bay Ordnance Depot, South Baltimore, Md.
Hardy, Rosswell E., Maj., (Instructor) Command and General Staff School, Fort Leavenworth, Kans.
Harmon, Kenneth B., Col., Raritan Arsenal, Metuchen, N. J.
Harris, Charles T., Jr., Brig. Gen., Assistant to the Chief of Ordnance, Washington, D. C.
Harris, John P., Maj., Philadelphia Ordnance District, 1466 Nemours Building, Wilmington, Del.
Harrison, Edwin H., Capt., Ordnance Office, Washington, D. C.
Haskell, Robert K., Capt., Watertown Arsenal, Watertown, Mass.
Hatcher, James L., Lieut. Col., Springfield Armory, Springfield, Mass.
Hatcher, Julian S., Lieut. Col., (Staff) Ordnance School, Aberdeen Proving Ground, Md.
Hauseman, David N., Maj., Ordnance Office, Washington, D. C.
Hayes, Thomas J., Lieut. Col., Springfield Armory, Springfield, Mass.
Heiss, Gerson K., Capt., Office of the Assistant Secretary of War, Washington, D. C.
Henry, William J., Maj., Manila, P. I.
Hine, D. L., 1st Lieut., Watervliet Arsenal, Watervliet, N. Y.
Hinrichs, John H., Capt., Frankford Arsenal, Philadelphia, Pa.
Hirsch, George W., Maj., (Instructor) Ordnance School, Aberdeen Proving Ground, Md.
Hofstetter, Clarence F., Maj., Ordnance Field Service School, Raritan Arsenal, Metuchen, N. J.
Hogan, Randall J., Capt., Pittsburgh Ordnance District, 1046 New Federal Building, Pittsburgh, Pa.
Holler, Walker W., Capt., Picatinny Arsenal, Dover, N. J.
Holman, Jonathan L., Capt., Army Industrial College, Washington, D. C.
Holmes, Joel G., Maj., (R.O.T.C.) Leland Stanford Jr. University, Stanford University, Calif.
House, William E., Capt., Springfield Armory, Springfield, Mass.
Hubbell, Richard L., Maj., Ordnance Office, Washington, D. C.
Huff, Sargent P., Maj., Army Industrial College, Washington, D. C.
Huffsmith, Victor C., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Hughes, Everett S., Col., Ordnance Office, Washington, D. C.
Huling, John, Jr., Maj., Rock Island Arsenal, Rock Island, Ill.
Humphries, Ferdinand M., 1st Lieut., Watertown Arsenal, Watertown, Mass.
Jank, Otto M., Capt., (R.O.T.C.) University of California, Berkeley, Calif.
Jeffus, Charles J., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Jenks, Glen F., Col., Ordnance Office, Washington, D. C.
Jervey, Thomas M., Maj., March Field, Riverside, Calif.
Johnson, Alfred B., Lieut. Col., Army Industrial College, Washington, D. C.
Joiner, William H., Maj., Ordnance Office, Washington, D. C.
Jordan, Harry B., Col., Nansemond Ordnance Depot, Portsmouth, Va.
Katz, Henry J., 1st Lieut., Honolulu, T. H.
Keck, Charles H., Maj., Hq. Third Corps Area, U. S. Post Office and Court House, Baltimore, Md.
Kelly, David C., Maj., Fort George G. Meade, Md.
Kemble, Franklin, Jr., 1st Lieut., Springfield Armory, Springfield, Mass.
Kennedy, Grafton S., Maj., Watertown Arsenal, Watertown, Mass.
Kibler, Edgar H., Jr., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Kiehl, Philip J. R., Col., Hq. Seventh Corps Area, Federal Building, Omaha, Nebr.
Kimble, Samuel R., Maj., Raritan Arsenal, Metuchen, N. J.
Kirk, James, Lieut. Col., Frankford Arsenal, Philadelphia, Pa.
Kirsten, Elwyn N., 2nd Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.

Klanderman, Russell R., 1st Lieut., Savanna Ordnance Depot, Savanna, Ill.
Kresge, Miles W., Maj., Ordnance Office, Washington, D. C.
Krupp, Oscar, Lieut. Col., Benicia Arsenal, Benicia, Calif.
Kutz, Harry R., Lieut. Col., Ordnance Office, Washington, D. C.
Laidlaw, Waldo E., Capt., Ordnance Office, Washington, D. C.
Larned, William E., Lieut. Col., Picatinny Arsenal, Dover, N. J.
Latimer, William J., Jr., Capt., Hq. Fifth Corps Area, Fort Hayes, Columbus, Ohio.
Lavin, Gregory S., Maj., Hq. Second Corps Area, Governors Island, N. Y.
Leedy, Myron, Capt., Army Industrial College, Washington, D. C.
Lemon, George F., Col., Hq. Third Corps Area, U. S. Post Office and Court House, Baltimore, Md.
Leonard, Lawrence C., Capt., U. S. Military Academy, West Point, N. Y.
Lewis, Burton O., Col., Aberdeen Proving Ground, Md.
Lewis, Hubert du B., 1st Lieut., Aberdeen Proving Ground, Md.
Ludlam, Douglas G., Capt., U. S. Military Academy, West Point, N. Y.
Luke, Ittai A., Maj., Ogden Ordnance Depot, Ogden, Utah.
Luse, Arthur H., Maj., Fort Lewis, Wash.
Lynn, Edison A., Maj., Langley Field, Hampton, Va.
MacGregor, Stephen H., Lieut. Col., Augusta Arsenal, Augusta, Ga.
MacMorland, Edward E., Lieut. Col., Office of the Assistant Secretary of War, Washington, D. C.
Manlove, Almon W., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Marsh, Raymond, Lieut. Col., Fort Benning, Ga.
Martin, Daniel J., Capt., Ordnance Office, Washington, D. C.
Mather, John, Col., Watertown Arsenal, Watertown, Mass.
Mathews, Elmo S., Capt., Ordnance School, Watertown Arsenal, Watertown, Mass.
Maxwell, Russell L., Lieut. Col., (G.S.C.) Office of the Chief of Staff, Washington, D. C.
McClelland, Chalmer K., Jr., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
McCulla, William L., Capt., U. S. Military Academy, West Point, N. Y.
McFarland, Earl, Brig. Gen., Assistant to the Chief of Ordnance, Washington, D. C.
McGehee, James L., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
McGregor, Duncan G., Maj., Hq. Second Corps Area, Governors Island, N. Y.
McInerney, James E. B., Capt., Ordnance Office, Washington, D. C.
McIntyre, James D., Maj., Office of the Assistant Secretary of War, Washington, D. C.
McMahon, Fred A., Maj., Cincinnati Ordnance District, 521 U. S. Post Office and Courthouse, Cincinnati, Ohio.
McMorrow, Francis J., 1st Lieut., Wright Field, Dayton, Ohio.
McNerney, Joseph A., Capt., Erie Ordnance Depot, LaCarne, Ohio.
Meals, Robert W., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Meany, William F., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Mechling, Edward P., Capt., Langley Field, Hampton, Va.
Meek, Sterner St. P., Maj., Corozal, C. Z.
Meeks, John A., 1st Lieut., Picatinny Arsenal, Dover, N. J.
Melin, Reynold F., Maj., Honolulu, T. H.
Menoher, William, 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Mesick, Benjamin S., Capt., (R.O.T.C.) Lehigh University, Bethlehem, Pa.
Mettler, Charles G., Col. (Unassigned—awaiting retirement.)
Meyns, Lawrence J., Maj., Hq. Fourth Corps Area, Post Office Building, Atlanta, Ga.
Mikkelson, Harry E., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Miles, Francis H., Jr., Col., (Commandant) Army Industrial College, Washington, D. C.
Miller, Leland A., Maj., Ordnance Office, Washington, D. C.
Minton, Henry E., Maj., Honolulu, T. H.
Minton, Hugh C., Lieut. Col., Ordnance Office, Washington, D. C.
Mitchell, Franklin, Capt., Sperry Gyroscope Company, Brooklyn, N. Y.
Mohlere, Edward D., 1st Lieut., Ordnance School, Watertown Arsenal, Watertown, Mass.
Moody, Lucian B., Col., Hq. Second Corps Area, Governors Island, N. Y.
Moore, Wiley T., Capt., Selfridge Field, Mount Clemens, Mich.
Morgan, Clyde H., Maj., Wright Field, Dayton, Ohio.
Morris, Thurman W., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Murphy, Daniel J., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Murphy, Edward A., Lieut. Col., Benicia Arsenal, Benicia, Calif.
Neary, James S., Capt., Wright Field, Dayton, Ohio.
Niblo, Urban, Capt., Raritan Arsenal, Metuchen, N. J.
Nickerson, Lewis A., Lieut. Col., Fort Sill, Okla.
Niles, Wallace E., Capt., Aberdeen Proving Ground, Md.
Nisley, Harold A., Maj., (R.O.T.C.) Massachusetts Institute of Technology, Cambridge, Mass.
Nixon, Thomas H., Capt., Fort Knox, Ky.
O'Leary, Herbert, Col., Corozal, C. Z.
Olmsted, Burnett R., Maj., Ordnance Office, Washington, D. C.
Orcutt, John W., Maj., Picatinny Arsenal, Dover, N. J.
Osborn, Norris W., Maj., (1st Division) Madison Barracks, Sackets Harbor, N. Y.
Outland, George W., Maj., Aberdeen Proving Ground, Md.
Partridge, Clarence E., Col., Hq. Eighth Corps Area, Fort Sam Houston, Tex.
Peoples, Ulysses J. L., Jr., Capt., Command and General Staff School, Fort Leavenworth, Kans.
Pillivant, Ray A., 1st Lieut., Springfield Armory, Springfield, Mass.
Pinger, Roland W., Lieut. Col., Hq. Ninth Corps Area, Presidio of San Francisco, Calif.
Pinkerton, Charles R., Capt., Rock Island Arsenal, Rock Island, Ill.
Powell, Grosvenor F., 1st Lieut., Fort Bliss, Tex.
Proctor, J. Worthen, Maj., Ogden Ordnance Depot, Ogden, Utah.
Purnell, Edward K., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Quinn, Horace A., Capt., Ordnance Office, Washington, D. C.
Quinton, Alfred B., Jr., Lieut. Col., Ordnance Office, Washington, D. C.
Raaen, John C., Capt., Frankford Arsenal, Philadelphia, Pa.
Ramsey, Norman F., Col., Rock Island Arsenal, Rock Island, Ill.
Reber, E. C., Capt., U. S. Military Academy, West Point, N. Y.
Reed, C. Wingate, Capt., Ordnance Office, Washington, D. C.
Reed, Charles S., Maj., Springfield Armory, Springfield, Mass.
Reed, Frank F., Maj., Langley Field, Hampton, Va.
Reedall, Harold M., Maj., St. Louis Ordnance District, 405 U. S. Custom and Court House, St. Louis, Mo.
Regad, Eugene D., Capt., Picatinny Arsenal, Dover, N. J.
Register, Charles L., 2nd Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Rehm, Harold W., Lieut. Col., York Safe and Lock Company, York, Pa.

Reimel, Stewart E., Maj., Ordnance Office, Washington, D. C.
Rice, Albert S., Capt., Ordnance Office, Washington, D. C.
Rising, Harry N., Maj., Ordnance Office, Washington, D. C.
Ritchie, Scott B., Maj., Watertown Arsenal, Watertown, Mass.
Rodenhauser, J. F., 1st Lieut., Picatinny Arsenal, Dover, N. J.
Rogers, George D., Capt., Picatinny Arsenal, Dover, N. J.
Rogers, Jesse A., Jr., Maj., Hq. First Corps Area, Army Base, Boston 9, Mass.
Rose, John B., Col., Aberdeen Proving Ground, Md.
Rowland, Garland T., Maj., Augusta Arsenal, Augusta, Ga.
Rutherford, Harry K., Col., Office of the Assistant Secretary of War, Washington, D. C.
Sadtler, William F., Capt., Ordnance Office, Washington, D. C.
Safford, H. F., Maj., Watervliet Arsenal, Watervliet, N. Y.
Sams, James D., 1st Lieut., Fort Benning, Ga.
Sayler, H. B., Lieut. Col., Ordnance Office, Washington, D. C.
Schomburg, August, 1st Lieut., Aberdeen Proving Ground, Md.
Schwartz, Philip, Capt., Ordnance Office, Washington, D. C.
Sears, Robert, Col., Hartford Ordnance District, 3640 Main Street, Springfield, Mass.
Seleen, Paul M., Capt., Ordnance Office, Washington, D. C.
Serrem, Mark M., Maj., Picatinny Arsenal, Dover, N. J.
Shaffer, Forrest C., Maj., Picatinny Arsenal, Dover, N. J.
Shaler, Harrison, Capt., Delaware Ordnance Depot, Pedricktown, N. J.
Shinkle, Edward M., Col., Picatinny Arsenal, Dover, N. J.
Shinkle, John G., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Shumate, Paul W., Capt., University of California, Berkeley, Calif.
Simon, Leslie E., Capt., Aberdeen Proving Ground, Md.
Simpson, Bethel W., Lieut. Col., Ordnance Office, Washington, D. C.
Simpson, Charles L., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Skinner, Asa H., Maj., Erie Ordnance Depot, LaCarne, Ohio.
Skinner, Leslie A., Capt., Honolulu, T. H.
Slaughter, Willis R., Maj., (R.O.T.C.) Cornell University, Ithaca, N. Y.
Smellow, Samuel, 1st Lieut., Aberdeen Proving Ground, Md.
Smith, Edward W., Capt., Hq. Sixth Corps Area, Post Office Building, Chicago, Ill.
Smith, Phillips W., 1st Lieut., Graduate School of Business Administration, Harvard University, Cambridge, Mass.
Smith, Robert McK., Capt., Honolulu, T. H.
Soderholm, Walter H., Maj., Office of the Assistant Secretary of War, Washington, D. C.
Somers, Richard H., Col., Watervliet Arsenal, Watervliet, N. Y.
Spalding, Sidney P., Lieut. Col., Springfield Armory, Springfield, Mass.
Steese, Charles M., Col., Hq. First Corps Area, Army Base, Boston 9, Mass.
Stewart, Gilbert H., Col., Springfield Armory, Springfield, Mass.
Stiegler, Harry L., 2nd Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Stribling, Simpson R., Maj., Ordnance Office, Washington, D. C.
Strickland, Newton H., Maj., Raritan Arsenal, Metuchen, N. J.
Stuart, Alexander J., Col., Ordnance Office, Washington, D. C.
Stuart, Alexander J., Jr., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Studler, René R., Maj., Assistant Military Attaché, American Embassy, London, England.
Sucher, Jacob G., Capt., Rock Island Arsenal, Rock Island, Ill.
Taber, Thomas R., Maj., Rock Island Arsenal, Rock Island, Ill.
Taylor, Galen M., Capt., Ordnance Office, Washington, D. C.
Taylor, Roger, Lieut. Col., Charleston Ordnance Depot, Charleston, S. C.
Terry, Carl C., Lieut. Col., Nansemond Ordnance Depot, Portsmouth, Va.
Thayer, Henry C., 1st Lieut., Aberdeen Proving Ground, Md.
Thorlin, John F., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Thummel, Claude B., Col., Hq. Sixth Corps Area, Post Office Building, Chicago, Ill.
Traeger, Charles H., Lieut. Col., Corozal, C. Z.
Trichel, Gervais W., Capt., Frankford Arsenal, Philadelphia, Pa.
Vander Hyden, Walter F., Maj., Birmingham Ordnance District, 302 Comer Building, Birmingham, Ala.
Van Gieson, Lewis M., Maj., Savanna Ordnance Depot, Savanna, Ill.
Van Roo, Robert, 1st Lieut., Picatinny Arsenal, Dover, N. J.
Van Syckle, David L., Capt., U. S. Military Academy, West Point, N. Y.
Vincent, Thomas K., Maj., Aberdeen Proving Ground, Md.
Wagner, Herman U., Maj., (Instructor) Ordnance School, Aberdeen Proving Ground, Md.
Waldmann, Carl A., Lieut. Col., Rock Island Arsenal, Rock Island, Ill.
Walker, Charles A., Lieut. Col., Manila, P. I.
Walker, John S., Capt., Frankford Arsenal, Philadelphia, Pa.
Walters, James W., Maj., (R.O.T.C.) University of Cincinnati, Cincinnati, Ohio.
Warner, Walter W., Maj., Ordnance Office, Washington, D. C.
Weber, John H., 1st Lieut., Aberdeen Proving Ground, Md.
Welch, Gordon B., Lieut. Col., Fort Monroe, Va.
Wells, Albert C., Jr., 1st Lieut., Ordnance School, Aberdeen Proving Ground, Md.
Wells, Gordon M., Maj., Frankford Arsenal, Philadelphia, Pa.
Wesson, Charles M., Maj. Gen., Chief of Ordnance, Washington, D. C.
Weyher, Theodore A., Capt., Aberdeen Proving Ground, Md.
Wheeler, John A., Maj., Fort Bragg, N. C.
White, George W., 1st Lieut., Aberdeen Proving Ground, Md.
Wilkins, Harold S., Maj., Picatinny Arsenal, Dover, N. J.
Willink, Arthur, Capt., Watervliet Arsenal, Watervliet, N. Y.
Willis, Harold A., Maj., Curtis Bay Ordnance Depot, South Baltimore, Md.
Wilson, William L., Maj., San Francisco Ordnance District, 118 Federal Office Building, San Francisco, Calif.
Winningstad, Olaf P., Maj., Hq. Second Division, Fort Sam Houston, Tex.
Woodberry, John H., Lieut. Col., Fort Bragg, N. C.
Woodbury, Grayson C., Maj., Fort Riley, Kans.
Woody, George A., Maj., Springfield Armory, Springfield, Mass.
Young, Cecil G., Lieut. Col., Watertown Arsenal, Watertown, Mass.
Young, Frederick R., 1st Lieut., (Instructor) Ordnance School, Aberdeen Proving Ground, Md.
Young, William C., Lieut. Col., Office of the Assistant Secretary of War, Washington, D. C.
Zeller, George A., Capt., Aberdeen Proving Ground, Md.
Zornig, H. H., Lieut. Col., Aberdeen Proving Ground, Md.

The following line officers are assigned as students in Course I, the Ordnance School, Watertown Arsenal, Watertown, Mass.

Bernd, Peter P., 1st Lieut., Infantry.
Brierley, James S., 2nd Lieut., Infantry.
Connelly, Stanley W., 2nd Lieut., Infantry.
Crabb, Frederick G., Jr., 1st Lieut., Infantry.
Dickson, John R. V., 1st Lieut., Infantry.
Kreiser, Oscar G., 2nd Lieut., Infantry.
Luckett, James S., 1st Lieut., Infantry.
Robbins, Asher B., Jr., 2nd Lieut., Field Artillery.
Robbins, Eldred G., Jr., 1st Lieut., Field Artillery.
Wood, Charles H., 1st Lieut., Infantry.

The following line officer is assigned as a student in Course II, the Ordnance School, Aberdeen Proving Ground, Md.

Stumpf, Robert H., 2nd Lieut., Infantry.

From the Record

The following quotations are from addresses or writings of recognized authorities and comprise a cross section of opinion on subjects closely allied to the national defense. They have been selected for publication as being important and timely. Through this medium, ARMY ORDNANCE *hopes to acquaint readers with qualified views regarding various phases of industrial preparedness.*

WAR IS THE MOST TRAGIC OF HUMAN UNDERtakings. It is frequently destructive and devastating. No responsible American citizen wants our country ever again to engage in war. Our national policy is one of nonaggression. Our chances of keeping out of war are perhaps better than those of any other major power. But, notwithstanding these facts, our history indicates that we are quick to go to war when the occasion demands. In fact, every generation of Americans born prior to 1918 has seen our country engage in at least one war. World conditions or the aggrandizing policies of other nations may force us into war whether we wish it or not. There frequently comes a time when, in the words of a great alumnus of this university—Woodrow Wilson—"the right is more precious than peace."

Once committed to war we must bend every effort to win a quick decision and thus minimize its destructive and devastating effects. The three factors necessary to obtain a quick and favorable decision are, in my opinion: (1) A high quality of leadership both on the fighting front and the home front; (2) Trained and disciplined troops sufficient in number for the job, and (3) Military armament of superior quality and ample quantity. May we always be thus prepared and may war not have to be fought. Our permanent preparedness will postpone that day, I hope with all my heart, indefinitely!—*Maj. Gen. C. M. Wesson, Chief of Ordnance, U. S. Army, before the Institute of Public Affairs, University of Virginia, Charlottesville, Va.*

WHILE THERE IS A REPORTED TREND ABROAD to displace the light field gun by a heavier weapon in certain units of divisional artillery, the advisability of such action lacks battle proof. Although a heavier weapon can fire a heavier projectile than one of 75-mm. caliber, the range of this proposed weapon is somewhat less than that of the modernized 75-mm. gun. Our last developed model of the 105-mm. howitzer is heavier than the 75-mm. gun and requires a considerably longer period to go into action. Time is a vital factor in opening fire with artillery which is in direct support of the infantry; any increase in this time must be accepted with caution.

We have long contemplated displacing the 155-mm. howitzer with the 105-mm. in the divisional artillery. Lacking weapons of this latter caliber, we have utilized the 155-mm. howitzer for the divisional howitzer regiment due to the large stock left over from the World War. We have provided in our fiscal year 1940 for one high-speeded battery of 105-mm. howitzers for service test. Further test of this weapon is necessary in order to determine its proper rôle; *i.e.*, whether it should replace the 155-mm. howitzer in the division, or whether it should partially displace the 75-mm. gun.

Our modernized 75-mm. gun is the best divisional light gun developed to date in any army. The high-speed 75-mm. gun (without the modernized carriage) can be moved rapidly to its firing position, but from a combat standpoint, after it gets there it is no better than the old war-time gun. The elevation permitted by its carriage gives a range of only 9000 yards.

Our modernized 75-mm. gun is also high-speeded, and, in addition, its range is 13,500 yards. Its arc of fire is fourteen times as great as that of the nonmodernized gun. Recent tests indicate that in firing at moving targets, such as tanks, for example, the modernized gun will obtain more than twice the number of hits than can be made with the nonmodernized weapon.

In the manufacture of artillery, the recoil system is the choke point. In modernizing the 75-mm. gun only a new carriage is required; the tube and recoil system are the same as in the war-time gun. Our present large stock of these parts constitutes a big asset. Also, we now have a large stock of 75-mm. ammunition on hand. The cost of modernizing a 75-mm. gun is approximately $8000; the cost of manufacturing a 105-mm. howitzer is approximately $25,000.

We have adopted the modernized 75-mm. gun as our standard divisional gun due to its outstanding characteristics. The estimates set up for these guns are deemed sound. They are based on present standards in weapons and on the requirements of our existing troops. Regardless of what use is eventually made of the 105-mm. howitzer, we will always have a need for the modernized 75-mm. gun in larger quantities than are now on hand. I strongly recommend modernizing 75-mm. guns.—*Gen. Malin Craig while Chief of Staff, U. S. Army.*

ONE OF THE SILLIEST STATEMENTS—AND MOST costly—ever announced was by an American statesman during the early days of the World War. . . . He opposed any preparedness measures on the part of the United States. He said that a million men could spring to arms overnight. We learned later to our utter dismay and chagrin that the men were willing, that they were capable of springing, but that there were no arms to spring to. Figuratively, it was a popular pastime in those days for demagogues to preach that armament grew on trees. Today we know far better. We know that the United States can train, house, feed, clothe, transport, and keep in good health the men who compose its armies in time of war at a much faster rate than industry can produce the weapons of defense. . . .

Those who supply the fighting man with his weapons are entitled in all fairness to the praise and thanks of our people. It is a popular pastime of pacifists to paint the armament maker, in peace and in war, as a profiteer. To do so is grossly unfair and equally untrue. All of us as decent American citizens are determined that excessive profit must be taken out of war. Today, war's burdens must be equalized as much as can be. But do not forget that if you deprofitize war you must deprofitize it for everyone—the arms maker, the shoemaker, the haymaker and the trouble maker. Elaborate plans for controlling this, that, and the other, so as to minimize profit are usually the work of childish minds whose wish is father to the thought. The most equitable and the soundest method of treating profits in time of war is through taxation—not confiscatory taxation but sane, sound, fair treatment of all citizens, share and share alike. You can render no greater service to the national defense of your country than by maintaining the high interest you always have shown in the welfare of our fighting forces. Their welfare depends upon every human being in our country. A great factor in their success in peace and war is the tremendous defense potential of American industry. That industry must be kept in a healthy, sound condition; inroads must not be made into its structure; its fabric must not be weakened. The men who compose it must be treated fairly whether they be of management or labor. For make no mistake in this, if you weaken American industry you weaken our national defense, and this is a day when strength at home is one of the greatest assurances that our peace and security as a leading power of the world will continue. This peace and this security are the sole objectives of our preparedness.—*Col. Frederick H. Payne, former Assistant Secretary of War, to the Veterans of Foreign Wars, Greenfield, Mass.*

THE WORLD TURMOIL OF TODAY IS SUCH THAT war is not only a possibility, but must be considered a probability. I am not speaking as an alarmist and I do not predict that we will be involved in any major war; nevertheless, the possibilities of a great conflagration exist and there is nothing for us to do but be ready to defend our interests and maintain our national integrity should another Armageddon occur.

I believe that I may say without exaggeration that the Navy is irrevocably dependent upon industry today, that the Navy's appropriations are a great factor in the progress and stabilization of industry, and that both the Navy and industry are so dependent upon industrial technology that without it we should neither have the industrial civilization which gives America her living standard, nor the Navy to guarantee the protection of that civilization which is the keynote of our very existence.

Before closing may I take just a moment for a thought not perhaps coming within the strict purview of our subject but certainly closely allied to it, and that is, while in our present world conditions preparedness may not keep us out of war, lack of it not only invites war but utter disaster, and a rich man, with his castle well guarded, sleepeth in peace, or at least in relative peace.—*Adm. Harold R. Stark, U.S.N., Chief of Naval Operations, to the alumni of Massachusetts Institute of Technology, Boston, Mass.*

THE WORLD IS ACCUSTOMED TO THINK OF THE leader's position as one of privilege. He seems to have advantages that other men would gladly receive. And it is too often the case that positions of leadership are converted to the purposes of personal advantage. Too often, as of old, the ambitious ask of the Lord of Creation, "Grant that we may sit, one on Thy right, and the other on Thy left, in Thy glory."

To him who would lead men, either in peace or war, the answer comes back, today as 2000 years ago, "Whosoever will be chief among you, let him be your servant." This is the first principle and basis of leadership in all great human activities. And in no walk of life it is so true as in the profession of arms. The first duty of the military leader is the welfare of his men. He fails to lead at all who fails to meet this demand. Only when he has met it will there be that unity of soul in the organization that leads on to victory. Only then will we be able to call on every man for the expenditure of his last ounce of energy, his last drop of blood, in grueling strain of the forced march and the red battle.—*Maj. Gen. George A. Lynch, Chief of Infantry, U. S. Army, to the graduating class of the Infantry School.*

DURING THE PAST EIGHT YEARS, CAVALRY HAS conducted intensive study and development in mechanization. Our studies and experiments have convinced us that we can apply automotive machines to the execution of cavalry missions to a very considerable extent. We are satisfied that the iron horse is here to stay. Each year, however, brings a more complete realization that the present development of fighting machines falls far short of the requirement that mobile warfare places upon cavalry, our most mobile ground fighting force. I am convinced that American horse cavalry today constitutes the most effective highly mobile fighting force in the world for operations on the American continent or similar areas. I am equally convinced that combined with a proper proportion of mechanized cavalry, the capabilities of cavalry are greatly increased.

Our problem is perfectly clear. It consists of continuing the improvement of our iron horses of every type, always with a view to increasing the mobility and fighting power of cavalry, at the same time continuing to increase these same qualities in our horse units, and finally to maintain a proper balance between horse and mechanized units so that our cavalry as a whole will always be at maximum efficiency.—*Maj. Gen. John K. Herr, Chief of Cavalry, U. S. Army, before the Committee on Appropriations, House of Representatives.*

Communications

OUR HEAVY FIELD WEAPON

THE EDITOR:

An article by Col. R. McT. Pennell, president, Field Artillery Board, in the July-August 1939 issue of ARMY ORDNANCE (Vol. XX, No. 115, p. 22) entitled "Our Heavy Field Weapon," makes a very unfavorable weight comparison between the German 150-mm. gun model 16 matériel and the U. S. 155-mm. gun M1 matériel. The article gives a weight of 30,765 pounds for the U. S. gun and states that "the German 150-mm. gun, model 16, with a maximum range of 22,000 meters (about 24,000 yards), firing a 115-pound projectile, weighs 22,308 pounds in firing position."

The above statements are true, but without amplification the conclusions are misleading, as will be seen from the following data:

	German Gun	*U. S. Gun*
Elevation	42 degrees	65 degrees
Traverse	4 degrees	60 degrees
Road speed	Slow	High
Weight (firing)	22,308 lbs.	27,965 lbs.
Weight (traveling)	31,889 lbs.*	30,765 lbs.

*Two loads.

The limited traverse of the German gun permits of a box-trail construction and a minimum of width and complication in carriage structure. The wide traverse and high angle of fire required of the U.S. gun by the Caliber Board necessitates a split trail with each trail member having sufficient strength to take a large percentage of the firing load, two sets of spades, a wider and more complicated and heavier carriage construction.

The German matériel is designed for slow speed and is transported in two loads. The U. S. matériel is transported in a single load at a speed limited only by the prime mover. Of the 30,765-pound U.S. vehicle, 2000 pounds are limber and 800 pounds are spare wheels and accessories. The requirement of the Field Artillery that no pit be required for high-angle firing has necessitated a very great overhang of the tipping parts and the addition of an elaborate equilibrator system. The loading problem incident to rapid high-angle firing has imposed a more elaborate elevating system than would otherwise be required.

The low ground pressure under the wheels, the freedom from transport wagon delay due to loading and unloading a 24-foot, 9300 pound gun in the field, the wide traverse, the high-angle fire without a pit, the fact that the carriage is sufficiently strong to take the new 8-inch howitzer—all help to explain the greater weight found in the U.S. 155-mm. gun M1 matériel.

Washington, D. C. T. A. CONLON.

SPRINGFIELD ARMS

THE EDITOR:

The article on the Springfield Armory, in the July-August issue, is one of the most interesting and inspiring narratives I have read. I want to congratulate the author upon his research and ARMY ORDNANCE upon its attractive presentation. I wish copies were available for general distribution.

Philadelphia, Pa. EDWARD R. MAY.

(This article, in response to popular demand, has been reprinted in pamphlet form for complimentary distribution. We propose to publish similar articles from time to time.—ED.)

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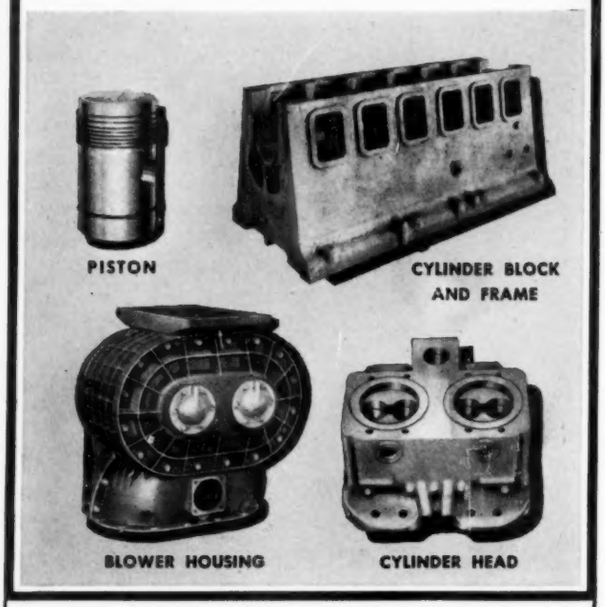

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Professional Digest

The following abstracts are based on current periodicals and events and aim to present a wide range of facts and opinions regarding recent developments of professional military interest. Quotation marks are omitted but sources are indicted.

THE LONG-AWAITED REVISION OF THE INfantry Drill Regulations has been approved by the War Department and announcement made that the new drill formations will be employed by the various components of the Army this fall.

The new regulations are the result of extended studies by the Office of the Chief of Infantry, the Infantry Board and the General Staff and of extended tests at Fort Benning, Ga.

The new regulations have been designed to provide a system of drill which can be used by any type of organization. Changes in strength or weapons will not necessitate revision of drill procedure. This has been effected by adopting the so-called "column of three" drill with provision to permit its use in column of fours for units whose squads are not in multiplies of three. The positions, steps and marchings performed by the individual soldier remain substantially unchanged. The marching cadence, however, has been reduced from 128 to 120 steps per minute. A few of the more difficult operations in the manual of arms have been simplified.

A primary advantage of the revised drill regulations lies in the simplicity of the movements, which will facilitate instruction of recruits. The new drill procedure also will facilitate the prompt movement of units and individuals into battle formations, according to the announcement.

ASSISTANT SECRETARY OF WAR LOUIS JOHNSON termed sixty-two graduates of the Army Industrial College who received diplomas from him at the annual commencement exercises, fortunate in graduating at a time when both Congress and the public were giving the supply features of national defense their keenest attention. Col. F. H. Miles, Ord. Dept., commandant of the college, introduced Mr. Johnson.

The graduates, assembled in the Public Health Service Building at Washington, were told by the Assistant Secretary that they owed loyalty both to the democracy under which the United States was established and to the capitalist system which has given the greatest happiness to the greatest number.

The student officers were told that industry would want to know from them what plans Government had for business in event of an emergency. It was made clear by Mr. Johnson that the Government under any consideration is not planning to take over industry in an emergency. Industry and the Army, he said, both have their fields of labor.

The following Ordnance officers were among the graduates: Lieut. Col. Harry R. Kutz, Maj. David N. Hauseman, Maj. Richard L. Hubbell, Maj. Leland A. Miller, Maj. Walter H. Soderholm, Capt. Benjamin S. Mesick, Capt. Philip Schwartz, Capt. Paul M. Seleen, and Capt. Galen M. Taylor.

AT PRESENT, BECAUSE OF SCARCITY OF FUNDS, the Chemical Warfare Service has not reserves of gas masks sufficient to equip the Initial Protective Force, according to the *Army and Navy Journal*. The only Government source of mask supply is the Edgewood Arsenal, Maryland.

A distinct forward step has been taken, however, with the recent letting of a contract with Goodyear Tire & Rubber Company for the equipping of a gas mask assembly plant at Akron, Ohio. This plant, when completed, will be capable of turning

out 100,000 gas masks a month with an 8-hour shift or 300,000 masks a month with three shifts.

The cost of producing the new mask varies with the amounts ordered, averaging about $9.25 to $9.50. Large orders, such as would be required in war, would bring the price down to about $5 or $6. Maj. Gen. Walter C. Baker, Chief of Chemical Warfare Service, testifying before the House appropriations subcommittee this year, stated that his service had produced two designs of a gas mask for civilian use, one of which would cost about $1.25 to make. This mask, which he termed superior to that issued to civilians by the British Government, is similar to that in use by our service but of less hardy materials.

There is a general misunderstanding of the life of the service mask. The canisters, for example, which contain the filter, would have to be replaced about every three months, or sooner if worn in a gassed area. The elastic headbands retain their elasticity about six months at least, and may then be replaced by any soldier. So too may the rubber outlet valve, which has a life of about a year. The mask itself will last perhaps eight years if given reasonable treatment.

THE DOUGLAS AIRCRAFT COMPANY OF SANTA Monica, Calif., has been awarded a contract amounting to approximately $15,000,000 for the production of a new design of attack bomber for the Army. The price includes spares, but does not include the cost of engines, propellers, armament, radio equipment, etc., furnished by the Government.

The bomber is an all-metal monoplane powered with the large Wright "Cyclone" engine with supercharger. Some of these planes are equipped with Hamilton Standard propellers and some with Curtiss electric propellers. The new craft is equipped with flaps or air brakes, retractable landing gear, radio, and all the modern aids to safety and efficient flying. The Douglas Company's designation for this plane is DB-7. The Army Air Corps number has not yet been assigned.

The present attack bomber is the result of intensive studies made of the aircraft used in operations in both Spain and China. By taking advantage of the lessons learned in these conflicts it has been possible to combine in a single plane the good features of the attack plane, which has been developed primarily by the United States, and of a light fast bomber. In recommending the purchase of this attack bomber, Maj. Gen. Henry H. Arnold, Chief of the Air Corps, advised Acting Secretary of War Louis Johnson: "This plane has a better performance than any comparative airplane in production or in service anywhere in the world today."

The Acting Secretary of War also announced awards to the Glenn L. Martin Company, Baltimore, Md., and to the Stearman Aircraft Company, Wichita, Kans., for the production of their attack bombers in the amount of approximately half a million dollars each.

The bombers to be procured under the award to the Martin and Stearman companies are essentially the same as those which were entered at Dayton in the attack-bomber competition, circular proposals for which were opened on March 17th. The improvements found to be desirable as the result of extensive tests will be incorporated into the airplanes to be produced as the result of this award to the two companies.

THE BRITISH AIR RAIDS PRECAUTIONS DEPARTment has devised a metal bombproof shelter which can be set up without difficulty in one's own back yard and occupied during an air raid. So far the tests of the contraption have been limited to bombing the empty shelters, and they have stood up very well. It is now being proposed that the experiments be continued with human beings occupying the shelters while the bombs are dropped around them.

During the war in Spain and China it developed that more people were killed and maimed by bomb fragments and by

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falling hardware from bursting antiaircraft shells than from direct hits. These "sardine-can" shelters, as they have been dubbed by British Tommies, or "dog kennels" as they are also called, have proved to be effective protection from bombs exploding as near as twelve feet from them.

THE BUREAU OF LABOR STATISTICS, DEPARTment of Labor, has estimated that for each $1,000,000 expended on construction, 40.6 per cent is spent for material, 39.1 per cent for labor, with the remaining 20.3 per cent for other expenses. Of this yardstick of a million dollars, 40.6 per cent, or $406,000, is expended for materials, as follows:

Aluminum sheets, shapes and castings, $2,000; boilers, $10,000; bolts, nuts, washers, and rivets, $3,000; electrical machinery apparatus and supplies, $52,000; electric wiring and fixtures, $24,000; elevators and elevator equipment, $4,000; engines, turbines, auxiliary machinery and equipment, $47,000; forgings—iron and steel, $10,000; foundry and machine-shop products not elsewhere classified, $56,000; furniture and furnishings, $4,000; hardware—miscellaneous, $1,000; heating and ventilating equipment, $6,000; instruments, $2,000; lumber, $2,000; machine tools, $2,000; metal doors, shutters, molding, and trim, $4,000; nonferrous metal castings, sheets, pipe, and tubing, etc., $26,000; paints and varnishes, $3,000; petroleum products, $5,000; plumbing fixtures and supplies, $1,000; pumps and pumping equipment, $12,000; steel-works and rolling-mill products not elsewhere classified, $90,000; wall plaster, wall board, and insulation material, $2,000; wire and wireworks products, $5,000; other materials, $33,000.

THE DEVELOPMENT OF A NEW AIR-COOLED radial aircraft engine of completely new design recently was announced by the War Department. Built by the Pratt & Whitney Division of United Aircraft Corporation at East Hartford, Conn., the engine develops extremely high horsepower, although it is no larger in diameter than the 400-horsepower "Wasp" engine built by the Pratt & Whitney Company ten years ago. The reduced frontal area of the engine permits its use in modern high-speed aircraft without interference with the streamlining characteristics necessary for the attainment of top speeds. The new engine is a double-row radial with eighteen cylinders, nine in each bank. It weighs slightly more than one pound per horsepower.

THE FIRST 4-BLADE CONTROLLABLE PROPELLER to be constructed in the United States so far as is known, recently was installed for experimental purposes on the Army Air Corps Curtiss P-36 pursuit airplane at Wright Field, Dayton, Ohio. This is the same airplane recently used for the installation and experimental testing of dual, oppositely rotating propellers mounted in close tandem. The special objects of these experiments will be to obtain comparative performance data on the airplane when equipped with the two types mentioned above, and also when equipped with the usual constant-speed 3-blade type, according to the *Army and Navy Register*.

For a given propeller diameter, the solidity ratio of a propeller can be increased by adding blades. More efficient operation thus can be obtained for a given power and diameter at high altitudes, especially above 20,000 feet. The 4-bladed propeller used has a Curtiss electric, constant-speed hub equipped with dural blades of standard design. The rapid increase in engine powers for small airplanes, the pursuit types for example, necessitates an increase of effective propeller area (solidity ratio) without increase in propeller diameter. One solution for future design purposes, therefore, revolves about the use of propellers having four or even a greater number of blades.

Ordnance in Review

CIVIL WAR ORDNANCE, PART I

BY LIEUT. COL. CALVIN GODDARD, ORD. RES.

IN the January-February 1937 issue of this journal (Vol. XVII, No. 100, p. *223*), there appeared a 1-page article, editorially prepared, entitled "An Ordnance National Park," with the subcaption, "Petersburg Earthworks to Mount Civil War Cannon Once More." On the facing page was a map of the Petersburg (Va.) area and a list of the types and numbers of heavy ordnance employed by both besieger and besieged in the course of the military operations centering there in 1864-1865.

The article in question outlined a project for locating, securing, and setting up in the Petersburg National Military Park specimens of each of the artillery types named in the list just mentioned and disclosed the personnel of a committee of members of the Army Ordnance Association which had been appointed for the purpose of furthering the enterprise, one of whom was the writer. The names of certain officials of the National Park Service who had consented to act in an advisory capacity, commencing with that of its distinguished chief, Dr. Arno B. Cammerer, likewise appeared.

And so, for his own information and for that of the other members of the committee referred to and their advisers, the writer has prepared the following descriptive data which should serve to answer some, at least, of the questions which must have arisen in their minds as to the nature of the pieces which they have been assigned to discover and, if possible, secure for eventual emplacement at Petersburg. Bare names, without qualifying information, offer but little that is helpful. What, indeed, are the distinguishing characteristics of a Blakely, a Brooke, a Coehorn, a Columbiad, a Parrott, a Sawyer? And though space precludes outlining these in detail, it is hoped that the specifications set forth below may serve to clarify in some measure any doubt now existing in the minds of interested parties as to "which is which."

The list of artillery printed in ARMY ORDNANCE is reproduced below with explanatory remarks.

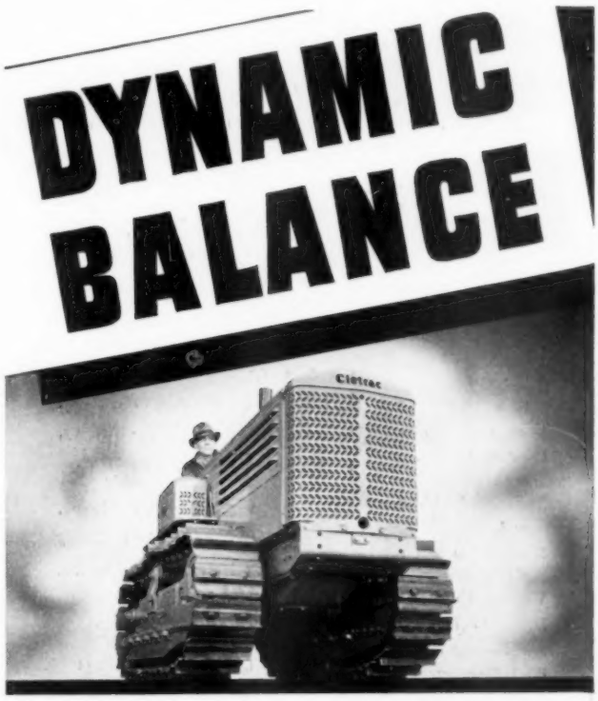
FEDERAL ARTILLERY

SIEGE, ARMY OF THE POTOMAC

30-pounder Parrotts, siege: These pieces, produced by Capt. R. P. Parrott in his West Point Foundry at Cold Spring, N. Y., were *rifled*, muzzle-loading, cast-iron guns, reënforced at the breech by a wrought-iron ring, applied hot and shrunk into place. The 30-pounder was 126 inches long, weighed 3400 pounds, had a bore diameter of 4.2 inches. With a charge of 3¼ pounds of powder its range at 15 degrees elevation was 4800 yards.

Coehorn mortars: The Coehorn (named for its inventor, a Dutch baron) was a smoothbore, bronze piece, only *22½* inches long and weighing 164 pounds. With a bore diameter of 5.82 inches it was rated as a 24-pounder, though its shell (empty) weighed but 17 pounds. With a charge of 8 ounces of powder it attained, at an elevation of 45 degrees, a range of 1200 yards. Mounted on a wooden base to which carrying handles were affixed, its light weight permitted transportation by hand from one position to another.

8-inch siege mortars: The 1862 Ordnance Manual (U. S. Army) describes no 8-inch *siege* mortar, though it does record the ranges of such a piece with varying charges of powder. Two types of *light* 8-inch mortars *are* listed, and there is reason to believe that the adjectives "light" and "siege" were used interchangeably. The "light" varieties included—M1841: cast-iron,



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smoothbore; length, 22½ inches; weight, 930 pounds; M1861: cast-iron, smoothbore; length, 22 inches; weight, 1010 pounds. The range of the 8-inch "siege" mortar (presumably the "light" model of 1861) was, with a charge of 2 pounds of powder and a 45-pound shell, 1837 yards at 45 degrees elevation.

4½-inch siege rifles: This piece (M1861) was of cast iron, 133 inches long, and weighed 3450 pounds. With a 36-pound shot and a charge of 7 pounds of powder, it developed a muzzle velocity of 1420 foot seconds.

8-inch siege howitzers: These varied according to model, thus—M1841: cast-iron, smoothbore, 61½ inches long, 2614 pounds; M1861: cast-iron, smoothbore, 60 inches long, 2600 pounds. With 4 pounds of powder and a 45-pound shell, these ranged to 2280 yards at an elevation of 12 degrees, 30 minutes.

12-pounders, field: These were smoothbore brass guns, of 4.62-inch bore diameter, varying according to model thus—M1839-1844: length, 85 inches; weight, 1757 pounds; M1857: length, 72.15 inches; weight, 1227 pounds. This latter was the so-called "Napoleon," named for its originator, Napoleon III of France. It fired a 12.3-pound shot a distance of 2000 yards at 10 degrees elevation with 2½ pounds of powder.

10-inch siege mortars: Here again, we find no 10-inch *siege* mortars officially described in the 1862 Ordnance Manual, though ranges for such are printed. Instead, "light" and "heavy" types in this caliber are listed. Assuming that the former were of the "siege" variety and the latter for *seacoast* defense, we have—M1841: (10-inch, light) length, 28 inches; weight, 1852 pounds; M1861: (10-inch, light) length, 28 inches; weight, 1900 pounds. These fired an 88-pound shell a distance of 2064 yards with a charge of 4 pounds of powder at 45 degrees elevation.

100-pounder Parrotts, rifled: These, constructed like the 30-pounders, were of 6.4-inch bore, 130 inches long (*in the bore*), and weighed 9700 pounds. The normal charge of 10 pounds imparted to a 100-pound shot an initial velocity of 1222 foot seconds.

20-pounder Parrotts, rifled: These likewise resembled the 30-pounders in make-up. They had a bore of 3.67 inches, were 94 inches long, weighed 1650 pounds and fired a 19-pound projectile with a charge of 2 pounds of powder.

12-pounder field howitzers: These (M1841) were smoothbore bronze pieces of 4.62-inch bore, 58.6 inches long, weighing 788 pounds. They fired an 8.34-pound shell to a range of 1072 yards with 1 pound of powder at 5 degrees elevation.

10-inch seacoast mortars: These (presumably of the "heavy" type listed in the '62 Manual) were of two models—M1841: iron, smoothbore; length, 46 inches; weight, 5775 pounds; M1861: iron, smoothbore; length, 47½ inches; weight, 7300 pounds. The latter fired a 98-pound shell 4250 yards at 45 degrees elevation.

10-pounder Parrotts, rifled: Of the same type of construction as the other Parrotts already described, these had a bore 3 inches in diameter and 70 inches long. Their weight was 890 pounds. A charge of 1 pound of powder projected a 10-pound missile.

3-inch ordnance, rifled: These may have been M1861, or M1862, or both. Specifications varied as follows—M1861: cast iron, 73.3 inches long; weight, 820 pounds; M1862: cast iron, 72 inches long; weight, 967 pounds. They fired a 10-pound shot (or shell) at a muzzle velocity of 1418 foot seconds, with a maximum charge of 2 pounds of powder.

32-pounder howitzers: This type (M1841—field) was of bronze, smoothbore, of 6.4-inch bore diameter, 82 inches long, and weighing 1920 pounds according to the description in the '62 Manual. It fired a 24.64-pound shell to a range of 1504 yards with 2½ pounds of powder at 5 degrees elevation.

24-pounder howitzer: This weapon (also M1841, field type) was likewise of bronze and smoothbored. Bore diameter was 5.82 inches; length, 71.2 inches, and weight, 1318 pounds. It fired an 18.8-pound shell some 1322 yards with 2 pounds of powder at 5 degrees elevation.

6-pounder Sawyer, rifled: A "Sawyer" gun was *any* muzzle-loading weapon of the day, originally produced as a smoothbore but later rifled with six lands and grooves according to the Sawyer principle, and designed for a special "Sawyer" shell. (See S. Sawyer's patent No. 13799, issued November 13, 1855.) Along the full length of the cylindrical portion of the latter were cast six lugs, or projections, equidistantly spaced and designed to register in the grooves of the piece firing it. They were of a composition of lead and tin and extended at the lower end slightly below the base of the missile. The overhanging tips thus formed were compressed to seal the bore when the charge was fired. The weight and dimensions of a Sawyer gun obviously varied with the piece chosen for conversion to the Sawyer specifications. The "6-pounder" referred to was probably a piece originally of 6-pound caliber according to smoothbore classification, which would give it a bore diameter of 3.67 inches.

13-inch seacoast mortar: Of these there were two types, both of cast iron and smoothbored, thus—M1841: length, 53 inches; weight, 11,500 pounds; M1861: length, 54½ inches; weight, 17,120 pounds. (Both of these are listed as "heavy" rather than "seacoast" mortars in the '62 Manual.) The 1861 model, with 20 pounds of powder and a 200-pound shell, attained a range of 4325 yards at 45 degrees elevation.

30-pounder, rifled (Brooke, captured from the Confederates): This was a cast-iron muzzle-loader, hooped at the breech with wrought-iron rings. It resembled in general the Parrott save that the reënforcing rings were *not* welded together and was made for the Confederacy at the Tredegar Iron Works, Richmond, under the supervision of Lieut. John M. Brooke, C.S.N.

FIELD ARTILLERY, ARMY OF THE POTOMAC

12-pounders, light: These are presumably 12-pounder Napoleons as described under "12-pounders, field" above.

3-inch guns: (See "3-inch ordnance, rifled" above.)

Coehorn mortars: (See "Coehorn mortars" above.)

SPECIAL NAME OR DESCRIPTION

Napoleons: (See "12-pounders, field" above.)

8-inch Columbiad: The Columbiad, developed by Colonel Bomford, U.S.A., was first used in the War of 1812 for firing solid shot. It combined certain features of gun, howitzer, and mortar, being originally a chambered piece. (The chamber was later omitted.) The calibers were uniformly large. By the period of the Civil War it had, because of insufficient strength to withstand heavy charges, been degraded to the rank of a shell gun. The 8-inch types had the following specifications—M1844: length, 124 inches; weight, 9240 pounds; M1861: length, 119.475 inches; weight, 8465 pounds. The latter projected a 65-pound shell to a range of 4812 yards with 15 pounds of powder at 27 degrees, 30 minutes elevation.

100-pounder Parrott on Dahlgren carriage: (See "100-pounder Parrotts, rifled" above.)

100-pounder Parrott on siege carriage: (Same as above.)

5.8-inch Sawyer gun: (See "6-pounder Sawyer, rifled" above.)

24-pounder Coehorns: (See "Coehorn mortars" above.)

3.8-inch Sawyer: (See "6-pounder Sawyer, rifled" above.)

3-inch Parrott: (See "100-pounder Parrotts, rifled" above.)

10-inch guns: These were presumably either 10-inch seacoast howitzers or 10-inch Columbiads. The former (M1841) was a smoothbored, iron piece 124.25 inches long, weighing 9500 pounds and firing a 90-pound shell some 1650 yards with 12 pounds of powder at 5 degrees elevation. The latter varied in specification according to model; *viz.*, M1841: length, 126 inches; weight, 15,400 pounds; M1861: length, 136.66 inches; weight, 15,059 pounds. This type fired a 128-pound shot to a range of 5654 yards with 20 pounds of powder at an elevation of 39 degrees, 15 minutes. (*The conclusion of this article, containing descriptive data on Confederate ordnance captured in the siege of Petersburg, will be published in the next issue.*)

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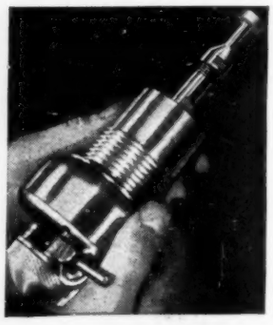

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Book Reviews

BOMBS BURSTING IN AIR. By George Fielding Eliot. New York: Reynal & Hitchcock. $1.75.

AMID the chaos of contemporary reasoning on most subjects, military and otherwise, the success of Major Eliot in popularizing the elements of sound military thought, and especially of American national strategy, is an encouraging sign of the times. If he sometimes has seemed to play into the hands of the left-wing propagandists by crediting Germany and Italy with various fell designs against the United States when they have much more urgent matters to attend to nearer home, this is far outweighed by the light he has thrown on many important matters concerning war which too often are clouded by ignorance or deliberately misrepresented by advocacy.

In the present book he has increased his reputation by helping to puncture the myth of the all-powerful and all-destroying airplane. He gives the air-frightfulness people their due; indeed, in his account of the effectiveness of the thirteen raids made on Barcelona in a little more than forty-one hours in March of last year he gives them perhaps a little more than their due. Here his citations from Langdon-Davies as to the "considerable" material damage might usefully be balanced by quoting Temperley and also the correspondents who later entered the city with the Nationalist Army, to the effect that except near the port the material damage was trifling. These however are matters of detail, and in general he expresses clearly and forcefully the almost universal conclusion of instructed men as to the popular exaggeration of air power. As he justly observes, to try to win a war by air action, even when you have, like Germany, the world's greatest air force plus a favorable target like England, is "a great gamble" with many chances against its success. As to the United States, he repeats the sound thesis of his "Ramparts We Watch"; *i.e.*, that with reasonable and moderate precautions we are secure behind our oceans. Our chief need is for vigilance against the establishment of potentially hostile air bases on this continent. Secondly, we would do well to keep an eye upon West Africa, from which our communications with Atlantic South America might be threatened.

Incidentally, Major Eliot criticizes effectively the idea that in point of European military preparation, time is on the side of the so-called democracies. The French Army cannot be increased; the new British forces will number less than two-thirds of the Czech troops already lost to the possible anti-German coalition, and the Italian naval strength will almost equal that of France in two years' time. Moreover, each year gives the Germans a new contingent of trained officers and a new "class" of trained reserves. H. N.

LORD KITCHENER. By Lieut. Col. H. deWatteville, British Army. Glasgow: Blackie and Son, Ltd. 5 shillings.

THIS is the eighth and latest of the "Order of Merit" series, comprising the lives of distinguished soldiers, sailors, and civilians of modern times. Like others of its type, it is largely a condensation of multivolume biographies. Its greatest value is in enabling the average reader to cover vastly more ground than would otherwise be possible.

Most of the volume is devoted to an account of the rise of the young Engineer officer, through commander of the Egyptian army to British Secretary of State for War, and to the course of world events as they impinged upon Kitchener and his work. Colonel deWatteville's handling of his subject is admirable. Though he shows the enthusiasm without which a biography is

dull and lifeless, he appraises frankly and without bias. The author early strikes the note which is the key to Kitchener's entire life and character—his singular aloofness. This it was which held him so far above the common mind with its multitudinous fallacies and prejudices; but this characteristic also hindered him from successfully swaying others with persuasive speech or personal charm. Throughout the book, Colonel de-Watteville keeps this fact in the foreground by comparing Kitchener to that character of Rudyard Kipling's—"The cat who walked by himself." He also shows that it is difficult to overestimate the part played by "K" in saving Britain from disastrous defeat in the Great War.

It is a pity our American officers produce so few books of this type, and that our publishers usually double the purchase price. F. W. F. G.

NOTES ON A HALF CENTURY OF UNITED STATES NAVAL ORDNANCE, 1880-1930. By Capt. Wilbur R. Van Auken, U. S. Navy. Washington, D. C. $1.

THIS little volume of fifty-six pages is a friendly and fascinating account of ordnance development in the United States Navy. The text begins at a crucial time in the genealogy of armament. The year 1880 was coincident with the exit of smoothbore guns and the advent of steel. It was also coeval with the beginnings of electricity. The growth of modern ordnance dates from this period. The newer forms had their first tests during the last ten years of the nineteenth century, climaxed by the Spanish-American war. The third period, 1900-1916, saw the development of modern gunnery. And 1917-1919—the World War period—coincided with the years of greatest demand on weapons and on the methods of development and production. During the postwar and treaty period, 1920-1930, the tempo of ordnance development slowed down, but the quality of armor, gun, torpedo, bomb and fire control, advanced greatly. The Navy of 1939 reflects the researches of the earlier decade.

This volume appropriately is dedicated "to those of the United States Navy and the American citizens interested in the development of ordnance and gunnery for our fleet, who have contributed their parts in building up the offensive and defensive weapons of our ships of the air, of the surface and beneath the seas, of yesterday, today and tomorrow, and published by the friends of the late Rear Adm. Ralph Earle, U.S.N., Retired, Chief of Bureau of Ordnance throughout the World War, 1917-1918." O. E. D.

THE ARMY OFFICER'S ANNUAL POCKET REFERENCE BOOK AND 1939-40 CALENDAR. Compiled and published by Capt. Peter Rodyenko. Manhasset, L. I., N. Y. $1.

THE author, in the preface to this first edition, succinctly states the purpose of this handbook. It is "to save the average Reserve or National Guard officer, R.O.T.C. and C.M.T.C. student the trouble of acquiring a large library of War Department publications and to serve as a handy reference while engaged in active- as well as inactive-status work." The text is the outgrowth of the author's experience with Reserve officers whose questions he tabulated. The answers are the context of the book.

Here are assembled not only the salient points of the regulations, customs of the service and current procedure, but also well-formulated advice as to conduct and deportment. The text contains a wealth of current Army information and is arranged with a monthly calendar and diary in which the officer can record his participation in active-duty or conference assignments. Possession of this text could well be taken as an indication of a Reserve officer's interest in his commission and as a help to his fitness. O. E. D.

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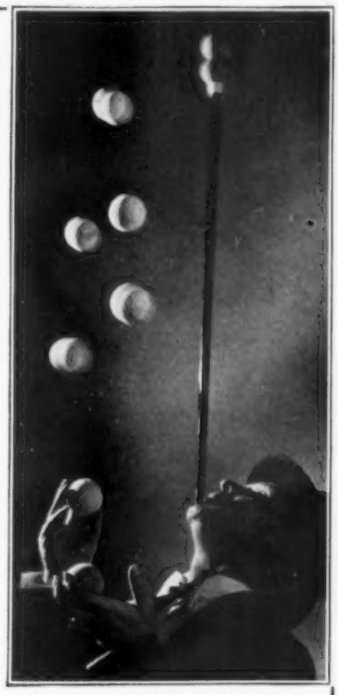

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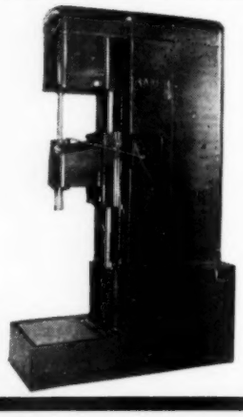

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